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ABSTRACT

This publication reviews the state-of-the-art of competency-based education (CBE) and discusses alternative methods for the development of CBE programs in public school systems. It begins with a discussion of the possible influences of various learning theories on the structure and content of competency-based systems. It then focuses in turn on alternative methods for competency identification, alternative methods for competency instruction, alternative methods for competency assessment, and alternative methods for developing CBE instructional management systems. The paper describes different approaches to these activities that are being used or considered in Oregon and elsewhere in the United States, exploring some of the strengths and weaknesses of each approach. (Author/JG)

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ALTERNATIVE METHODOLOGIES FOR
COMPETENCY BASED EDUCATION:
THE STATE-OF-THE-ART

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PREFACE

In this paper, a review of the state-of-the-art of competency based education (CBE) in elementary and secondary schools is presented. While a great deal of interest is being shown in CBE by state and local educators, implementation of CBE programs by public school systems is only beginning to take place. A paper of this nature may be useful in helping uncommitted decisionmakers formulate more rational decisions about selection and adoption of CBE. This paper may also be of value to the already committed as they attempt to implement a more effective and efficient CBE program.

This paper reflects, in part, ideas and information presented in other OCBE Program documents currently in preparation. For example, Paper 1, The Minimum Standards for Competency Based Education in Oregon: An Overview, describes the state and local context of OCBE Program activities. Paper 2, Alternative Models of Competency Based Education, presents a working definition of competency based education and describes some potential variations in its manifestations. Paper 4, Strategies for Implementation of CBE Models, discusses procedures for facilitating CBE program installation and for maintaining effective program operation, and suggests some tentative implications for OCBE Program technical assistance activities.

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Reviews of early drafts of this paper by Walter Hathaway and Allan Olson led to substantial modifications and improvements to the paper.

PURPOSE AND CONTENT

This paper discusses alternative methods for the development of competency based education programs in public school systems. The paper presents these methods in relation to four specific activities that are commonly pursued in the process of adopting and implementing competency based educational systems in elementary and secondary schools:

1. identification of competencies to be achieved by students
2. development of instruction related to the competencies
3. development of assessment procedures to determine competency attainment
4. development of instructional management and recordkeeping systems to certify student achievement of competencies and to support program evaluation and adaptation.

The paper describes the approaches to these activities that are currently being considered or adopted in Oregon and throughout the country. It also explores some of the strengths and weaknesses of each approach.

Background: CBE in Oregon

Because a competency based program is well underway in Oregon, that program will be frequently referred to in this paper as an example of methods employed to implement CBE. The Oregon State Board of Education began the process of implementing competency based education in 1972 with the adoption of the first of two statewide policies that would require a systematic, competency based response from local school districts. The new Oregon Minimum Requirements for High School Graduation amplified the standard course and attendance requirements expected of graduating seniors to include competency criteria as well (i.e., students must demonstrate their ability to perform in certain identified areas).

A second policy, the Oregon Minimum Standards for Elementary and Secondary Education, was adopted in 1974 and included standards for school certification that would require the development of competency based education programs in elementary and secondary schools throughout the state. A review of these two important policy statements appears below.

Oregon Minimum Requirements for High School Graduation

With the adoption of these requirements in 1972, the Oregon Board of Education required a comprehensive implementation response from local districts by 1978, allowing a six-year period for the development of competency based graduation systems. Because the new requirements changed the criteria for determining whether or not a student merits a high school diploma, they also changed the systems that schools must implement to measure and record student performances of these criteria. An example of some of the CBE-related requirements for both students and school districts are as follows:

- successful demonstration by students of district determined competencies
- identification of performance indicators acceptable to the district as evidence that individual students have attained the specific minimum competencies
- development of mechanisms to assure careful monitoring of student progress in attaining competencies and provisions for appropriate instructional help.
- development of recordkeeping systems to ensure that student achievement of competencies is documented and transferred to student transcripts
- development of "course statements" relating to the graduation requirements for all secondary-level courses (e.g., statements of goals, minimum competencies to be taught in courses, instructional options, and evaluation methods)

Oregon Minimum Standards for Elementary and Secondary Education

The new minimum standards were adopted by the Oregon Board of Education in 1974, with a requirement that local districts implement them on a staggered schedule beginning in 1975 and ending in 1981. These standards, which are used to evaluate schools and make school districts eligible for state financial support, changed the focus of school accreditation. While the previous standards focused on system "inputs" (the number of books in the library, classroom space, recreation equipment, etc.), the new standards focused on system "outcomes" and "processes" (content and method of instruction, student skills, teacher preparation, etc.).

Competency based features of the new minimum standards for Oregon school accreditation are listed below:

- provision to elementary students of opportunities to acquire knowledge and skills applicable to the minimum competencies required for graduation as adopted by the receiving high school
- adoption of a system of instructional planning which will: provide for establishing goals (K-12); allow for community participation in selecting instructional outcomes; include assessment of student performance; and apply this data to decisions on instructional priorities and program changes
- initiation of a classroom system of diagnosis and prescription to assure that each child acquires basic communication and mathematics skills and also acquires a basis for achieving competencies
- adoption of policies and programs which assure that services such as transportation, building construction, and media centers effectively support the operation of the competency based instructional program

Background: CBE in Other States

A number of other states, or local districts within other states, have taken steps towards the establishment of programs identified as competency based. The following list, which is not comprehensive, briefly describes some of the current programs for CBE implementation (Clark and Thompson, 1976):

Alaska

The Anchorage Borough School District adopted competency based graduation requirements in basic English and math skills in August 1975. Students are first evaluated during the third quarter of the tenth grade for their ability to meet the proficiency levels required for graduation. If students fail to demonstrate the required proficiency, they are enrolled in special remedial classes to help them meet these requirements by graduation.

The Craig City School District in Alaska has adopted a competency based approach to earning credit towards graduation. Student mastery of specific instructional objectives is determined by performance tests; passing the test earns the student the appropriate credit.

California

The Los Angeles Board of Education passed a graduation requirement for reading competency in January 1976. All candidates for high school graduation must demonstrate reading skills at a proficiency level that will be adequate to meet their survival needs in contemporary society.

Colorado

For fifteen years, the Denver School District has required their high school graduates to demonstrate proficiency in language, reading, spelling and arithmetic.

Florida

Because the State Commissioner of Education felt that a current Florida high school diploma contained no information that would indicate whether or not the student could read, he initiated a second "special" diploma that would indicate competency in basic skills. While students may earn a regular diploma without passing a competency test, they receive special recognition if they pass it.

Duval County has developed a new Functional Literacy Test (including computation) for use as a graduation requirement.

Indiana

In September 1974, the Board of Education in Gary adopted a resolution to develop criterion-referenced tests to assess student competencies in reading, writing, spelling and mathematics. The first reading test, given to eleventh grade students in January 1976, will become a graduation requirement for the class of 1977. Tests in three other areas are currently being developed.

Louisiana

The State School Board of Education is currently considering the adoption of statewide competency requirements in reading and math, to be determined at the tenth grade level in anticipation of high school graduation. The State Department of Education will study the proposal and make recommendations to the Board.

Maryland

The Maryland State Board of Education expects to reach a decision this year on the implementation of competency based education.

Massachusetts

Phillips Academy in Andover requires graduating seniors to demonstrate competencies in reading and writing.

Minnesota

The St. Paul Open Schools have ceased to base their course credits on Carnegie units, substituting verification of competencies and experiences as graduation requirements. Students must demonstrate their abilities in six general areas to receive diplomas.

Nebraska

The Board of Westside Community Schools in Omaha adopted competency based graduation requirements in 1974. Students must meet certain requirements for course credit, but they must also demonstrate competency in the following seven areas: reading, writing, oral communication, mathematics, consumerism, the democratic process, and problem solving.

New York

The New York State Basic Competency Tests measure the minimum student mastery of basic competencies likely to be required in the adult world. The tests are recommended for the ninth grade level and measure skills in reading, mathematics, civics and citizenship, practical science and health, and writing. In 1979, reading and math tests will be required for a high school diploma. Other tests will be administered on an experimental basis beginning this year, with provisions for biannual test revisions.

The State of New York has also adopted the External High School Diploma

Program, allowing adults to qualify for their high school diploma through a series of competency based assessments that measure such items as purchasing skills, occupational awareness, monetary awareness, and family medical awareness.

Texas

The Texas Adult Performance Level Program provides adults with a way of gaining a high school diploma by demonstrating their mastery of selected competencies. Take-home tests and trained interviewers assess adult skills related to consumer awareness, societal awareness and functional literacy.

Utah

The Salt Lake City School Board of Education has mandated as a goal for this year, the establishment of competency based instruction. The Board has also adopted the programs to verify competency achievement prior to graduation.

In Spanish Fork, Utah, the Nebco School District has instruments for the verification of competency attainment in career education, music, typing, physical science, geography, mathematics, home economics, and art.

Virginia

The Virginia Standards of Quality Act, effective in July 1976, required the development of minimum educational objectives and a uniform testing program in basic skills for statewide administration within the next two years. The skills identified for the competency based program include: functional literacy, computation skills, U.S. history and culture, and the ability to advance in schooling or obtain employment.

Greensville County in Virginia has adopted competency based minimum standards that apply to elementary students through high school.

A Summary of Nationwide Trends in CBE Programs

Some nationwide trends are beginning to emerge in the development of elementary and secondary competency based education. The following nine non-independent program types can be identified; they vary both in the nature of the competencies involved and in scope and methods:

1. Comprehensive K-12 Competency Based Education

   These programs apply the performance based education paradigm to the entire K-12 curriculum. They often identify the competencies to be achieved by the end of each unit of instruction and allow time and instructional setting to vary based upon individual students' needs, abilities and demonstrated performance. They may or may not be focused upon a set of terminal graduation competencies, possibly identified as necessary to function in life roles.

2. K-12 Competency Based Basic Education

   These programs also apply to the performance based education paradigm but only to the basic skill areas of the curriculum. They are often an early stage toward the evolution of comprehensive K-12 competency programs.

3. Competency Based Graduation Requirements

   Such programs focus upon a set of minimum competencies which all students must attain in order to receive a high school diploma. Such sets of minimum competencies are often limited to basic skill areas, but sometimes they include a wider range of life role relevant skills. Such requirements may compliment or supplement traditional attendance and credit requirements. Since such requirements are often imposed by state legislatures or other higher level governing bodies it is often left to the local systems to determine the instructional, assessment and management accomodations which need to be made in order to help students attain the competencies.

4. Adult Competency Based High School Certification

   These programs provide competency based assessment to determine the possession by adults of minimum skills required to meet equivalency standards for adult high school diplomas. They may or may not provide formal instructional assistance to those not able to demonstrate competence.

5. Competency Based Course Credit

These programs are sponsored by schools which no longer use Carnegie units (course hours) as a basis for granting course credit. Instead, these schools are developing assessment tools to measure competencies and are also often using verification of experience as the basis for granting course credit. Schools may be minimally involved, offering only one CBE course, and others may have implemented an entire spectrum of courses that are organized according to CBE principles thus approaching comprehensive K-12 competency programs.

6. Competency Based Basic Skills Diagnosis and Remediation

Some high schools administer a battery of competency based proficiency tests in selected basic skills early in their program. Generally, the purpose of these tests is to identify students who need special instruction in basic skills before they reach their final year of schooling.

7. Competency Based Assessment

This type of program adopts only the measurement aspect of the competency based approach applying performance based (criterion-referenced) tests to determine student mastery of their regular educational programs.

8. Competency Based Instruction

Some programs are primarily concerned with the exploration of CBE teaching techniques in the classroom, and are not using an entire CBE planning process. These teaching techniques may be derived from teaching/learning models, workshops, other CBE programs, texts, or audio visual materials.

9. Fostering of Generic Competencies

This approach assumes that fundamental cognitive skills underlie educational performance. "In fact, extension of the research indicates that these cognitive skills underlie all productive intellectual functioning" (Knott, 1976, p. 9). Knott has identified five cognitive skills as possible generic competencies:

- ability to review and discriminate among stimuli
- ability to sustain attention to selected stimuli
- ability to analytically order stimuli according to the problem at hand
- ability to reorganize relevant stimuli and apply them to the problem at hand
- ability to continually censor proposed ordering of stimuli in light of new information (Knott, p. 10)

With so many different types of programs that are being called competency based, it is easy to understand why there is so much confusion and disagreement about what the term signifies and what the benefits and effects of such an approach potentially are. Nevertheless, the rapid growth in both numbers and types of programs called competency based calls for thoughtful discussion and research on the State-of-the-Art of the CBE movement. In any such discussion, however, some definition such as that which follows must be attempted in order to facilitate understanding of the range of phenomena under consideration.

A Working Definition of Competency Based Education

Educators are not yet likely to agree on a terminal definition of competency based education because both the practice and the concept are in an evolutionary stage. While CBE may mean many different things to many people, some definition must, however, be attempted here in order to define the scope of discussion in this paper. A working definition can be sought by a brief consideration of the origins and common elements of CBE programs.

The Origins of CBE

Almost half the states in the nation as well as numerous local districts, schools and even individual teachers have made some attempts toward the implementation of what they call competency based education programs. Many of the state and district efforts have been mounted in response to a perception of the loss of public confidence in the schools. Public doubts about how schools are spending their tax dollars have been fed by a steady decline in national achievement testing data; national statistics about functional illiteracy; and reports from businessmen, employers, and receiving institutions that graduating high school students often lack basic skills essential to their survival and well-being in today's society. A common cry from the public sector has become "they have high school diplomas and they can't even read."

In response to this criticism, public schools began to describe outcomes of eductional programs in order to delineate what the public can or cannot expect from a given instructional program. In relation to diplomas, these outcomes describe essential or basic skills that have been determined as necessary for survival or well-being in our current society; often the skills are related to life role functions. Educators have also considered the criticism of the high school diploma as a "meaningless piece of paper", and began to state educational outcomes in performance terms, i.e., that students would demonstrate the ability, perform skills and tasks, not merely show class credits and courses taken. The performance outcomes that were developed to describe graduating seniors were generally referred to as competencies. From these procedures, there grew a frequent use of the term competency based education to describe high school graduation programs based on the ability to function effectively in life roles.

School and classroom based efforts in CBE directions are often motivated not so much by such external pressures as those to which state and district programs are responding; as by a professional search for more rational, satisfying, and effective approaches to teaching and learning.

Common Characteristics of CBE

The task of setting up a competency based eductional program at any level generally involves the following activities which together constitute a working definition of CBE:

- identifying instructional outcomes, often including those that relate to the ability to function effectively in life roles

- developing systematic instructional programs that are designed to attain the outcomes
- developing evaluation and assessment procedures that will measure the attainment of the outcomes
- developing instructional management and recordkeeping systems that will certify the attainment of the outcomes and support program evaluation and adaption.

An effort has been made to identify these common elements of CBE, in order to aid the reader in interpretation of this paper. These defining characteristics are not to be taken as the sole foundation upon which CBE programs can be built, for general reasons: First, they have been secured from the few operative programs throughout the nation. Second, the characteristics have been gathered through a review of the extant literature and programs to identify only elements that are common. Lastly, while these characteristics are shared by the programs, the programs are not universal in scope, purpose or procedure. They are all, however, operating under the current auspices of CBE.

The Content of the Paper

Obviously, this paper cannot present a detailed discussion and evaluation of every competency based program in the nation. It can provide a general outline of some current approaches to the task of implementing a CBE program. In many cases, the paper will focus specifically on CBE in Oregon, in order to provide one slightly more detailed account of the development of a particular program.

The paper also begins another line of inquiry by asking "what are the influences of recognized developmental and learning theories on the implementation of competency based education?" Competency based instruction requires the articulation of outcomes in relation to the learning process. For example, basic reading skills are selected as important competencies for a high school diploma requiring an instructional plan that will guide a student through the process of learning reading to achieve the competencies at the specified time. The learning theories of Gagne, Piaget, Bruner, Taba, and others are possible tools for the development of a fully articulated instructional program. These theories can influence the selection of outcomes, instructional methods, and assessment techniques. The paper begins with an inquiry into the possible influences of these theories on the structure and content of competency based systems. It then describes some alternative methods of implementing competency based education according to the following sequence:

- alternative methods for outcome and competency identification
- alternative methods for outcome and competency instruction
- alternative methods for outcome and competency assessment
- alternative methods for CBE instructional management systems

The paper ends with a conclusion which includes a discussion of some of the gaps in the State-of-the-Art of CBE and its methods.

ALTERNATIVE METHODS FOR OUTCOME AND COMPETENCY IDENTIFICATION

Reasons for Identifying Educational Outcomes

An examination of the methods for identification of the expected outcomes of instruction is a first step in a systematic approach to a discussion of the state of the art of competency based education, since competencies are treated in various programs either as synonomous with or at least as a subclass of the educational outcomes desired by the system. Once outcomes are identified, they become instrumental in program planning and evaluation; they also become a focal point for communication with students and staff about educational aims.

Specific outcomes are also useful in communicating with the public about what they can and cannot expect from schools. The current public concern over the tax dollar and their subsequent demand for educational accountability has precipitated an increasing interest in competency based educational systems. At least 19 states and numerous local education agencies have recently mandated the development of outcome based planning and evaluation systems.

In the analysis of any educational system, three basic questions must always be asked:

1. What is to be learned? (Planning)
2. What techniques can facilitate learning? (Instruction)
3. Has the learning taken place? (Evalaution)

Outcome identification provides an economical basis for finding answers to these questions.

The Outcome Identification Task

Learning outcomes are identified to answer the question, "what is to be learned?" As the first and essential step in establishing competency based education, the identification of outcomes will greatly influence the methods of instruction, assessment and recordkeeping that relate to it.

The problem of identifying learning outcomes is a difficult one, especially in relation to defining minimum life role competencies. Exactly what are the minimal skills required for survival and well-being in our society, and how does an educational system go about finding out? Are there studies to consult? Can certain people be asked? Do students know what they need? Have people done this before, and what did they decide? Who should have the responsibility of selecting the outcomes?

Approaches to the Outcome Identification Task

Differing approaches to the difficult task of identifying outcomes and competencies are being explored by theoreticians and followed by practioners. While the specific approaches that govern the identification process are too numerous to describe these general approaches can be singled out:

- analysis of the competencies implicit in the existing program or curriculum
- analysis of the tasks to be performed by certified students
- consensus between and among both the actors in the system and its clients

Some programs follow only one of these approaches, but more commonly two or even all three are employed within a single program.

Variables that Influence Identification of Outcomes

Whatever approach to the task of identification of outcomes is adopted by a system there are variables which strongly influence the process and shape its results. These variables may be categorized as follows:

1. the nature and influence of the governing authority
2. the beliefs and/or rationale employed by individuals and groups that identify the outcomes
3. the characteristics of the instructional program to which the outcomes apply (including life roles)
4. the characteristics of the students and community to whom the outcomes apply

The Nature and Influence of the Governing Authority

Instructional outcomes may be identified by many different bodies and for many different purposes using any of the three approaches described earlier. For example, a teacher may identify an outcome in an art program based upon an analysis of the existing curriculum. The State Board may identify outcomes as graduation competencies based upon an analysis of the task of driving and of driving laws in the state. And the federal government may establish outcomes whose pursuit and attainment are the conditions for eligibility for federal funding based upon the consensus of concerned legislators.

Because each administrative level in the educational process may have different goals, the identification of outcomes at the various levels will show related variations. There are at least six administrative levels which involve different types of people, with different professional goals and responsibilities, in the process of outcome identification:

- course (teachers and students)
- program (department faculty, program planners)

- school (faculty representatives, principal, PTA)
- district (school representatives, district administrators, local board, community)
- state (district representatives, legislators, state administrators, the state board, representatives of business and industry)
- federal (state representatives, legislators, federal administrators)

While any specific administrative body may consult with members of another group in identifying outcomes (e.g., the federal government may consult with students or parents), the final responsibility of selecting the outcomes will very likely be influenced by the nature of the governing authority.

Another obvious difference among identified outcomes might be the increasing degree of specificity as the decision making authority moves closer to the individual students. For example, a state level reading competency might be "demonstrates oral reading skills sufficient for well-being in contemporary society." A related classroom performance objective might be "demonstrates ability to read orally, at a rate of 50 words per minute with no more than three errors from a randomly selected nontechnical magazine or newspaper."

The Beliefs and/or Rationale Employed

While Beliefs play a more dominant role in the consensus approach to outcome identification, they also have some influence in the task or curriculum analysis approaches. Each individual involved in an outcome identification process probably has beliefs and persuasions, based on their personal experience in school as teachers or learners, or upon professional values about what education is supposed to do. Many of these beliefs may be based on some deficiency that the person discovered as they entered post high school experience. For example, "I went to college and didn't even know how to write a term paper. We need a competency about writing term papers." Of course, not every high school student goes to college or needs to write term papers. On a more useful level, an experienced English teacher might say "None of my students can sit down and write a business letter, yet they make plans for college or employment."

A room full of individuals with separate and strong beliefs about what every high school graduate needs can be a harrowing experience. A great difficulty in achieving consensus about the selection of competencies is the problem of sorting out personal beliefs and biases to arrive at some general agreement about what every student needs for a productive life. Decisions about educational outcomes based on beliefs are very often intuitive responses, creating a highly speculative approach to competency based education.

Also influential in the selection of learning outcomes will be the beliefs (or critical assumptions) that the individuals have about the purpose of competency based education. These assumptions can be very different, simply because of the lack of consensus on a definition and description of CBE. Some of these influential assumptions might include:

- the purpose of CBE is to insure a basic skills education, providing each student with the essential skills necessary for adult life.
- CBE is a process to provide public schools accountability to the taxpayers and should include all school programs.
- CBE can be used to require unproductive students to at least meet minimal skill competencies.

- CBE will provide an educational program to answer all of society's current needs.
- CBE can provide a more practical, satisfying and effective process of instructional planning.

Any group that is charged with the identification of learning outcomes and subscribes to one of the above beliefs will tend to construct a framework of learning outcomes that reflects that belief. It is highly possible that such a group will be comprised of individuals, each with a different belief about CBE. A great deal of time must be spent reaching an agreement to use as a basis for further work, i.e., answering the question "Just what is this CBE program supposed to accomplish?". Again, the lack of a clear definition of competency based education will delay the productive selection of learning outcomes.

Beliefs and Analytical Approaches

Beliefs play a relatively minor role in task or curriculum analysis approaches to outcome identification. Let us consider for example, the role of beliefs in a curriculum analysis approach. In this approach, an effort is made to reflect the basic curriculum and instructional program that has already been operating in the school system, generally the course content of the school (e.g., learning outcomes in social studies, English and geometry rather than in survival skills or life roles).

This approach avoids the necessity of negotiating with external individuals about their beliefs of what the outcomes of CBE should be, and also avoids the tremendous effort required to formulate an entirely new approach to instruction based on recently developed learning theories or new rationales. It still leaves room for professional bias, however, and excludes the possibility of making the dynamic improvements in the instructional program sometimes claimed for CBE. Students are still certified on the basis of classes oriented around subject matter or topics; they are usually not certified on the basis of their demonstration of more dynamic learning skills such as problem solving, transfer, and adaptation. The following section on rationales begins a discussion of how learning outcomes can be selected that will reflect new concepts of instructional programs design.

Rationale

Generally accepted theories about developmental and learning processes may provide a more reliable framework for outcome identification than one based on beliefs alone. Such theories tend to influence the analytical approaches to outcome identification. The conceptual and definitional components of learning theories can be used both in the selection of outcomes and the structuring of outcomes to articulate a sequential instructional program leading to the achievement of graduation competency.

Some examples of learning theories are summarized below, along with brief remarks about their possible influence on methods of identifying outcomes.

Gagne's Learning Hierarchy. Gagne's theory about the learning process specifies eight types of learning activities, progressing from the most simple to the most complex. The heirarchy begins with signal learning (e.g., not touching a frayed wire that has sparks coming from it) and concludes with problem solving (e.g., knowing what to do about the frayed wire), according to the following sequence: (1) signal learning; (2) stimulus/response learning; (3) motor chaining; (4) verbal association; (5) discrimination learning; (6) concept learning; (7) rule learning; and (8) problem solving. (For a more detailed discussion of this hierarchy, see Appendix A).

Outcomes that are influenced by this hierarchy will very possibly show a correspondence between the level of instruction and a level of Gagne's hierarchy. Let us consider for example, a team identifying learning outcomes for a reading program in the primary grades. The first outcomes might specify performance objectives that are low in the hierarchy (e.g., step 1, recognizing letters and words; step 2, saying letters and words; and step 3, reading sentences). Later outcomes might specify higher levels of activity in the hierarchy (e.g., step 5, reading two different stories and describing the difference; and 8, reading instructions for building an airplane and then building it). This particular theory will greatly influence outcome identification that is related to the sequential development of educational programs.

For example, a school district might select a series of reading outcomes, grades K-12, that correspond to Gagne's hierarchy. The terminal competencies would then be consistent with the highest level, e.g., using reading to solve problems. A classroom teacher might use the hierarchy as an approach to structuring an instructional unit, for instance a carpentry class that begins with recognizing basic tools and ends with building an object.

Piaget: Stages of Cognitive Development. Piaget's stages of cognitive development describe the kind of learning that is characteristic of four age/stage groups: (1) birth to 2 years, development of sense and motor activities; (2) 2 to 7 years, gradual acquisition of ability to conserve and decenter, but not capable of operations; (3) 7 to 11 years, capable of operations restricted to concrete experience; (4) 11 to 14 years, capable of transfer of operations, dealing with abstractions, hypotheses and possibilities. Central to Piaget's stages is the idea that the growing child can comprehend an increasingly wide sphere of relationships. (For further explanation, see Appendix B.)

Piaget's system, like Gagne's, describes the orderly and sequential development of a child's learning. Followers of Piaget are likely to consider his developmental stages in the structuring of learning outcomes according to student age or grade level, and to seek performance criteria consistent with his analysis of a child's abilities at that particular developmental stage.

Bruner: Discovery Learning. Bruner describes learning as intellectual growth, which he defines as the ability to integrate and to use new information. Discussing his theory of how intellectual growth occurs, he questions other theories that contend that some learning experiences can be too difficult or complex for children in the early grades (i.e., Piaget). He proposes that it may be possible to teach practically all subjects, even to small children. The point that Bruner makes is that it is possible to teach complex subjects to even the very young if the material is structured in a manner which is compatible with the cognitive capacity of the learner. The key is structure of the to-be-learned material; it must be compatibly structured or it will prove dibilitating to the learner. (See Appendix C for a more complete discussion).

Taba: Levels of Thinking in Concept Formation and Ellis: The Transfer of Learning. Taba describes concept development according to four stages as follows: (1) differentiation (describing the different characteristics of objects or events), (2) grouping (dividing objectives or events into groups according to their similarities and differences), and (3) categorizing and labeling (including forming inferences to explain new phenomena). Taba's analysis of concept development would require learning outcomes that describe a sequence of these activities in order: describing, grouping, and categorizing and labeling. (See Appendix D for a more complete discussion).

Once a concept is developed, it is further desirable that the student be able to transfer these concepts and apply them in other disciplines. For instance, a student who understands how to locate information in the library can use this understanding to locate information on many different topics.

Transfer (the ability to apply skills in new situations) is receiving special focus as a necessary competency for students to acquire for life role functioning. Since schools can't predict future events and equip students to cope with rapidly growing technology, they can at least equip students with learning skills to apply in unknown future situations. In Oregon, a special category for learner outcomes that relate to transfer is identified as the role of the learner. When local districts design instructional programs to encourage the development of transfer skills, they may use Ellis' principles of transfer in selecting transferrable outcome procedures. Ellis states that transfer is most likely to be learned in a situation which provides early practice on similar tasks in similar environments with similar stimulus-response requirements. (For additional discusion of Ellis, see Appendix E).

Most of the learning theories discussed above would have their greatest influence on the sequential selection of outcomes to describe a particular instructional program (e.g., geometry class), or the selection of outcomes to describe a sequential curriculum that is geared towards the development of a terminal competency (e.g., a program to develop functional literacy, grades K-12).

More influential in the selection of outcomes related to competency based education, would be the characteristics that are agreed upon for the instructional programs — specifically, the life roles to which the competencies must apply.

Characteristics of the Instructional Program

Any state or district administrative body is likely to select a method of determining life roles or survival skills for CBE in a unique manner that suits their particular needs. The method will probably vary in relation to their understanding of what "life roles" signify -- ability to function in immediate surroundings? ability to grow and change in new situations, ability to use basic skills to solve problems? ability to achieve effective relationships in jobs, family, neighborhoods, or urban life?

Oregon has outlined six life roles that provide a framework for the selection of statewide learning outcomes in their CBE program. Many other competency based education programs in this country adhere to similar goals. The six life role elements identified by Oregon are:

- Individual: to develop the skills necessary for achieving and maintaining physical and mental health and to develop the capacity for coping with change through an understanding of the arts, humanities, scientific processes, and the principles involved in marking moral and ethical choices;

- Learner: to develop the basic skills of reading, writing, computing, spelling, speaking, listening, and problem-solving; and to develop a positive attitude toward learning as a lifelong endeavor;
- Producer: to learn of the variety of occupations; to learn to appreciate the dignity and value of work and the mutual responsibilities of employees and employers; and to learn to identify personal talents and interests, to make appropriate career choices, and to develop career skills;
- Citizen: to learn to act in a responsible manner; to learn of the rights and responsibilities of citizens of the community, state, nation, and world; and to learn to understand, respect, and interact with people of different cultures, generations and races;
- Consumer: to acquire knowledge and to develop skills in the management of personal resources necessary for meeting obligations to self, family, and society;
- Family Member: to learn of the rights and responsibilities of family members, and to acquire the skills and knowledge to strengthen and enjoy family life.

Oregon has also outlined nine program areas which direct the outcome and competency identification procedures. The nine program areas are:

- Language arts/English
- Mathematics
- Social studies/history
- Science
- Health education
- Physical education
- Consumer education/economics/personal finance
- Career education

To provide coherence between the life roles and program areas, Oregon has outlined ten competency domains that are strongly interrelated to both categories. These competency domains are:

- Read, listen, speak, write
- Analyze
- Compute
- Use basic scientific and technological processes
- Develop and maintain a healthy mind and body
- Be an informed citizen in the community, state, and nation
- Be an informed citizen in interaction with environment
- Be an informed citizen on streets and highways
- Be an informed consumer of goods and services
- Function within an occupation or continue education leading to a career.

The conceptual framework developed in Oregon for the statewide identification of learning outcomes has these three interrelated specifications: life role areas, traditional subject matter designations, and ten competency domains. Local districts in Oregon are therefore provided with some very direct information to assist them in developing CBE programs. Other states, working under less closely defined criteria, may come up with life role identifications and instructional frameworks that have quite a different effect on the identification of learning outcomes. One element that may influence the local responses to statewide descriptions of instructional programs is the nature of the students and public that the instruction is intended to serve.

Characteristics of the Students and Community

The nature of the student population in any given CBE program will influence the identificaiton of learning outcomes according to at least two classes of characteristics; (1) the future expectations of the student population; and (2) the current educational status of the students. For example, if learning outcomes are being identified for a school in which most students will expect a career in rural occupations; they are likely to differ from the outcomes that are identified for a large urban school in a metropolitan center. The life role competencies for survival in rural and urban settings may be quite different. Learning outcomes will vary according to the predominant pattern of student activity after graduation. If most students attending a particular school attend four year college programs, the learning outcomes will probably describe more academic behaviors than a school with a predominantly vocational oriented student body. If a school population shows diverse patterns of post high school activity, the learning outcomes should set up more options than those for schools with relatively homogeneous populations.

The current educational status of the student population will also determine the identification of learning outcomes. The most obvious example of this variable is the existence of a bilingual or predominantly foreign language speaking student population. Learning outcomes in a functional literacy program will probably reflect the current abilities of the students in the English language. A particular student population might also show highly developed skills (e.g., in environmental awareness or in orientation towards work experience). A selection of learning outcomes for that particular student population could focus more strongly on areas of weakness; also, learning outcomes could possibly reflect somewhat higher life role expectations in those areas. Interrelated with the characteristics of the student population are the characteristics of the community that the school serves.

Community characteristics that will influence the selection of learning outcomes can be environmental, occupational, or related to life-style and parental expectations of the schools. A school located in a tornado belt might select learning outcomes that describe survival skills in a tornado. A school that serves a tourist trade community could emphasize marketing and public service programs in their identified learning outcomes. If the community is made up of stable family units, life role competencies might be different than a community with a large population of broken families, single persons or a transient population. The parents in a school's community will also have a strong influence on the selection of learning outcomes, reflecting their personal beliefs and biases about what their school is supposed to be doing.

Further Inquiry into the Influence of Variables

The previous discussion of ways that four selected classes of variables can influence the three approaches to identification of learning outcomes begins to define a way in which methods of selecting instructional outcomes might be described. Further inquiry might investigate existing CBE programs, determining how much and what kind of influence these variables have had in already completed processes of outcome identification. Such an inquiry might begin to provide a systematic description of some alternative models for the identification of outcomes; these models can be reviewed and discussed by educators who are implementing new CBE programs.

The following sections contain a description of some current guidelines and models for the process of outcome identification that have been used in Oregon.

The section concludes with a discussion of the difficulties that are currently apparent in the attempts of states and school districts to identify and articulate competencies for life role functions. These difficulties also suggest areas for further inquiry related to outcome identification.

Outcome and Competency Identification in Oregon

Oregon has completed the statewide phase of outcome and competency identification for its CBE program. In order to gain a better understanding of the identification sequence, a representative sample of Oregon school district competencies is presented, by category, in Appendix F. There are many differences in the competencies selected by each district, possibly reflecting the different approaches that each district used as they progressed through the identification phase.

Additional State Guidelines

The state mandated specific areas that were to be addressed by the competencies. The local school districts carried out the identification process to fulfill the state mandated requirements. After the competencies were identified, two additional sets of guidelines were employed by the OCBE Program staff to categorize the compiled competencies. These guidelines were employed to categorize competencies according to their function, academic or applied and according to the taxonomical domain to which they pertained, cognitive, affective, or psychomotor.

Academic or Applied. The following list of competency statements by category is presented to provide examples of the distinction between academic or applied learning outcomes. Generally, academic outcomes refer to classroom or in school behaviors while applied outcomes refer to out of school behaviors.

Academic:

- The student will write a report on a selected topic.
- The student will give an oral presentation in class..
- The student will understand the meaning of a fraction.

Applied:

- The student will understand the laws of the highway.
- The student will know how to vote in community, state, and national elections.
- The student will know how to deal with personal stress.

Cognitive, Affective and Psychomotor. The second guide presents a way of categorizing competencies according to the learning domain of the required response. These domains address the intellectual (cognitive), emotional (affective) and physical (psychomotor) nature of the response activity.

Cognitive:

- The student will solve problems using scientific and technological processes.
- The student will understand basic physics principles.
- The student will be able to analyze candidates platforms in order to vote intelligently in an election.

Affective:

- The student will maintain a positive attitude in a working atmosphere.
- The student will articulate feelings about classroom relationships.
- The student will understand ways of coping with grief over the death of a loved one.

Psychomotor:

- The student will demonstrate the ability to perform the fundamental activities related to two leisure sports.
- The student will demonstrate basic physical fitness exercises.
- The student will know principles of physical safety in the performance of physical tasks in a work situation.

(See Appendix G for a complete list of the three domain hierarchies, giving examples of the use of infinitives and direct objects in the writing of competencies).

The three domain taxonomies described above were used for the purpose of categorizing competencies after they had been identified. However, it is also possible that these domain hierarchies could influence the actual selection of competencies, if the group doing the identification was cognizant of them. At the identification level, the domains would then operate as an additional influencing variable in the decision making process; they would tend to structure the identification of learning outcomes in sequences or hierarchies, thus facilitating the sequential description of behaviors according to their level of difficulty (i.e., from simple to complex activities).

The three domains also allow the teacher to make distinctions about the nature of outcome desired instruction. For example, if a student wishes to progress beyond rote performance to a "thinking" mode, he can find in the taxonomies (in this case cognitive) what to aim for.

Examples of Methods Employed in Oregon to Identify Competencies

Following are some examples of methods employed in the consensus gaining processes which may illustrate the differences found in the competencies list. These examples are drawn from recent or current methods employed in Oregon, and appear in a publication from the Oregon Department of Education (Fairbanks, 1976). The models were used in Oregon, but many were developed in other locations and by federal agencies, research organizations, and local school districts.

- Educational Goals and Objectives Model: This community-school goal setting (outcome identification) program suggests a number of strategies for selecting members of the community committee. The method also describes procedures for ranking goals on a priority basis by a community committee; establishing priority goals for the district; writing performance objectives; and developing a management design and instructional programs to meet the performance objectives and the determined needs of the district.

- Emerald Goal Definition Process-School Planning, Evaluation and Communication System (SPECS): Program to provide a description of their goal setting strategy (outcome identification).

A group using this method of identifying outcomes agrees to the following description of their approach:

1. focus on instructional program goals.
2 focus on "student outcomes" rather than "program process goals".
3. no a priori limit on the number of goals.
4. no community involvement in assigning priorities to goals.
5. production of sentence-length goal statements, rather than single words, phrases, or lengthy paragraphs.
6. production of a single set, or hierarcy, of goals consisting of 104 district-level instructional goals in 13 broad goal areas.

- Project Interaction: This method can be used in a variety of settings including a school district or a local school. It is useful in establishing or improving board-district office and school-district office relationships. This method, though not specifically designed for curricular and instructional uses, also includes institutional and managerial techniques for identifying goals, outcomes, roles, and relationships.

- Reynolds-Delphi: This method involves the development of a project design and the formation of a district task force to set goals. Community members, school staff and students rank goals by responding to a questionnaire. The method has, as its objective, the development of clearly stated educational goals, endorsed by constituents, and capable of being translated into instructional objectives. This method gives citizens, teachers and students a sense of participation in goal setting, and in systematically identifying and developing instructional objectives.

- Rural Futures Development Strategy: When fully implemented, this method is designed to help educators, students, citizens, and school board members in rural communities form an effective working relationship; to help them use a systematic problem solving process to make educational improvements in their district; and to help state and regional educational agencies improve the support services provided to rural schools. The needs assessment provided through this method extends considerably beyond curricular and instructional needs.

- The Charrette: This program describes a technique for planning educational facilities. It has also been used for other purposes, such as writing educational specifications, stimulating change, solving problems, and identifying community goals. It provides for intensive planning by a number of professional and lay persons within a short period of time. Its applications extend well beyond the educational community.

- Data-Based Goal Setting Model: This process for establishing program and course level goals researches a process for setting program level goals based on established course, grade, and activity goals. It assesses attitudes among community members, students, and district staff, and provides data for setting goals.

- Warm Springs Curriculum Project: This project emphasizes involvement of the Indian community in setting project goals and developing curriculum materials to implement those goals.

- Tri-County Course Goals: This method includes development of a teacher-oriented goal based approach to identifying and evaluating program and course learning goals for grades K-12, for each of 12 subject areas. It also includes development of a classification scheme for knowledge, process and value-attitude goals, and taxonomies for those instructional fields for which goals are to be written.

Problems in the Development of Competencies: The Problem of Definition

It has already been stated that a predictable consequence of using different methods for identifying outcomes and competencies will be a wide divergence in selection within and among districts. Some clear examples of this divergence can be found in the Oregon school district competencies in Appendix H. Perhaps the fundamental difficulty of the task derives from the lack of a cohesive operational definition of competency. In Oregon, many attempts have been made to arrive at a definition. At the outset, competencies were characterized as survival skills to be demonstrated before graduation. The problem, of course, was deciding what survival meant — perhaps some minimal number of skills needed for existence in our society? Or did survival refer to Maslow's notion of a need hierarchy of which the first requirement is physical well being? Or did survival imply the ability to exist as a self-directed, self-fulfilled person? Did economic survival fit into the sequence? Should competencies be equated with knowledge and skills necessary to function as a producer and consumer, to function as a citizen, family member or learner?

Many early efforts by the Oregon school districts to identify competencies contained statements which suggested a continuum from highly specific tasks to the attainment of a complimentary complex of knowledge and skills. This particular type of competency is difficult to relate to some definitions of life role competencies. Nevertheless, these complex competencies have also been included in some Oregon CBE programs.

Pottinger describes some of the problems related to competency identification in his description of the practice (1975). He begins by identifying a positive influence of CBE: that it provides a way to award credentials for abilities that are essential to success, but have been previously ignored by educational credential systems — abilities such as maintaining positive personal relationshps, identifying values, accepting responsibility, persevering, and applying problem solving skills. At its best, CBE can include these previously neglected skills in lists of identified learning outcomes and begin to address national educational priorities in these areas.

On the other hand, current examples of the identification of competencies often disclose an opposite tendency — to articulate endless reductions of competencies for a specific skill, rather than to describe and assess broad skills or general competencies. For example, a set of competencies for the ability to form concepts includes three separate levels of activity: differentiation, grouping, and categorizing and labeling. A student is required to demonstrate each of these skills separately. According to Pottinger, "the 'overkill' of subcompetencies lacks the same meaning and relevance to students lives as the traditional learning agendas from which many have fled." (Pottinger, p. 8).

The current practice of job analysis using the CBE approach often reveals this same tendency, focusing on specific motor activities related to the job and ignoring other broader skills which may be essential to the work. For instance, a CBE carpentry program might specify competencies such as picking up a hammer, raising a hammer, bring the hammer down on the head of a nail (to provide an extreme example). The job analysis might lack such fundamental competencies as the ability to analyze a project and select the correct tools to complete it. "This approach to job analysis results in taxonomies of hundreds, sometimes thousands, of motor skills... which can be picked up on the job in a short period of time and are not worthy of attention in educational programs." (Pottinger, p. 9).

SUMMARY

The Oregon Department of Education has mandated an outcome based approach to curriculum and instruction as an integrating mechanism which (1) fosters increased cooperation among levels of the educational hierarchy (i.e., state, district, school building, classroom teacher, student); (2) encourages the explicit statement of goals and competencies at the district, program and course levels; and (3) provides a more easily accessible rationale for what is being taught.

In districts across the nation, various educational needs and public pressures have prompted educators to identify the outcomes and competencies that should result from schooling. Many methodologies exist or are under development at local and national levels, but are either inaccessible or inadequate to assist educators in meeting their needs.

Instructional strategies are integral parts of competency based education. Given the methods for identifying learner outcomes in this section, and the various levels at which desired learner outcomes may be specified the following section examines the available methods for implementing these outcomes in instructional programs.

ALTERNATIVE METHODS FOR OUTCOME AND COMPETENCY INSTRUCTION

Instruction in CBE Programs

Since instruction is the chief function of any educational program, the methodologies for the instructional subsystem of a CBE program are of paramount importance. The specific instructional methodologies are of course greatly influenced by the outcomes found within any one CBE system. As was pointed out in the previous section, these outcomes in practice range all the way from specific subject matter course level performance outcomes to broad life role related system outcomes. And even once a set of competencies is arrived at, a wide range of instructional methods are open to the system and its teachers. Nevertheless, there are six properties which are commonly found in instructional programs which are agreed to be exemplary of CBE. These six properties are:

- The instructional program is derived from and linked to specific competencies.
- Instruction is organized and implemented in such a way as to accommodate learner style, sequence preference, perceived needs, and pacing such that the time for instruction is allowed to vary from student to student and from outcome to outcome.
- The settings for instruction are adapted to the competencies and to student needs such that other settings than classrooms become more common.
- Learner progress is determined by demonstrated competency such that the student moves forward in the instructional sequence when he or she has demonstrated mastery.

- Learner progress is communicated to students throughout the program as a means of motivation and student control over their own instruction.

- Instructional methodologies are reviewed and revised on the basis of learner performance feedback data.

Instructional development can involve classroom teachers, students, parents, school administrators, district and state specialists, and advisory committees of outside professionals and community members. However, because it is the teacher who is usually responsible for the operational phase of program implementation, (i.e., putting the plans into effect), the role of the teacher in making the properties of CBE a reality will be the focal point of this discussion. The delineation of teacher competencies in Oregon in relation to CBE has been selected as a beginning framework for this discussion.

Identification of Teacher Competencies In Oregon

The Oregon Department of Education has conducted a study "...to identify the critical competencies needed by Oregon [educators] to implement the three major instruction-related sections of the new revised Minimum School Standards: Instructional Planning; Diagnosis and Prescription; and Educational Programs" (Hall, 1976, p 1). In all, 93 competencies have been identified, that relate to seven major functions: outcome specification, assessment, needs identification, needs prioritization, program development, program evaluation and review, and information management.

The Role of the Teacher in CBE

Seven basic activities for teachers can be identified through a consideration of the definition of competency based education, the Oregon Minimum Standards for Public Schools, and the writings of various authors (Fraser, 1974; Glaser and Rosner, 1975; Flanagan et al., 1975; Schalock et al., 1976; Talmadge, 1975).

DEFINITION OF MEASURABLE OUTCOMES

First the teacher must be able to define, adapt or select desirable learning goals, and be able to translate the goals into measurable outcome statements.

> The definition of instructional objectives instructs the [planner] and the teacher on how to proceed. But vague specification of the desired competence level does not give the teacher enough concrete information about what to provide the [students] to enable [them] to attain or surpass this performance (Glaser and Rosner, 1975, p. 89).

A working knowledge of the cognitive, affective and psychomotor domains, as well as familiarity with learning taxonomies, will be very helpful to teachers in the selection and writing of performance criteria. If teachers examine empirical data from other projects that have established performance criteria, the acccuracy and effectiveness of the measures they select may also be improved.

DIAGNOSIS OF INDIVIDUAL NEEDS

Second, the teacher must be able to diagnose individual or group learning needs in order to adjust the outcomes and procedures to meet specific individual differences. Effective diagnosis will prevent students from wasting time on instruction that is either too difficult or too easy.

> From this point of view, testing and teaching are inseparable aspects and are not two different enterprises...Frequent information about student performance is the basis on which the teacher decides the next instructional step. It also serves as feedback to the student. The information is also invaluable for the design and redesign of [instructional] materials (Glaser and Rosner, 1975, p. 90).

Various learning theories may be useful to teachers as they attempt to diagnose individual needs. For example, a student is working on spelling, but continually writes certain letters of the alphabet incorrectly; if the teacher is diagnosing according to Gagne's learning hierarchy, the student is likely to receive more instruction in the second step (i.e., stimulus-response learning, copying the letters correctly). If tests are structured to determine where a student's abilities break down, items can be selected that correspond with the sequences of established learning theories, probably providing a more precise determination of the level at which the mistakes begin to occur.

Hall (1976) identified teacher competencies in diagnosis and prescription that will fulfill the professional requirements of the Oregon Minimum Standards. She has determined that teachers should have the ability to:

- Apply to each student the district's measures, data collection policies and procedures to assess in basic skill areas:
    - a. learning strengths
    - b. learning problems
    - c. interests and potential.
- Use assessment data in judging when specialized diagnostic techniques are needed to determine possible causes of unsatifactory or exceptional instructional achievement by individual students.
- Select and apply specialized diagnostic techniques appropriate for detecting environmental, physical, mental or emotional factors which may be contributing to an individual student's unsatisfactory or exceptional achievement of learner outcomes (p. 17).
- Develop statements of instructional need for each student based on:
    - a. assessment data on the student's performance in basic skill areas
    - b. information resulting from the appropriate use of specialized diagnostic techniques (p. 19).

SELECTION OF INSTRUCTIONAL STRATEGIES

Third, once it has been determined that a student (or group) has the necessary prerequisites to learn a skill, the teacher must be able to select appropriate instructional strategies. Fraser offers the following definition:

> A strategy is any planned means selected to produce specified learner outcomes. Three general sub-components of a strategy are: social settings, instructional methods, [and] perceptual stimuli (1974, p. 1).

A number of instructional staff competencies well identified by Hall (1976) related to strategy selection such as the ability to:

Develop and implement learning plans for activities for each student that are:

a. in keeping with that student's needs, strengths, interests, potential, learning histories and styles

b. in keeping with district-approved program and course goals, basic skill and minimum graduation requirements.

Learning theories can also be useful in the selection of instructional strategies. For example, if a teacher has diagnosed a student as being unable to transfer,Ellis' principles of transfer may be called upon (i.e., task similarity, stimulus-response similarty, warm-up, practive at frequent intervals, etc.).

Once strategies are identified, it is important to also determine how they will be used.

> Adapting instructional strategies to individual differences is a function of both the behavior of the student and the nature of the subject matter being taught. It is important to emphasize at this point that [CBE] is accomplished by designing a particular curriculum for the needs of a student (the word needs is used operationally in terms of student characterisitcs that we can reliably assess and that are relevant to instructional decisions) ....(Glaser and Rosner, 1975 p. 92).

ARRANGEMENT OF THE LEARNING ENVIRONMENT

Fourth, the teacher must be able to organize the learning environment so that the learner can efficiently achieve his or her objectives. The environment should be arranged and managed to facilitate activities prescribed for the instructional staff and students (i.e., the implementation of the strategies).

The environment can take on different degrees of structure (e.g., open or closed physical arrangements);

different degrees of flexibility (e.g., use of furniture, space, materials and personnel); and different types of atmosphere (e.g., in light or dark, quiet or noisy, active or still). Competency based instruction implies that the environment is arranged to enhance the interaction of the learner with instructional resources. To the degree that an instructional program provides for multiple entry, branching options, or self-directed learning, it demands an environment that permits ready access to materials, media, movement, and alternative grouping options.

Teachers who are cognizant of the research in classroom application of operant psychology may find strategy selection a more manageable task. Studies in classroom management by Tosti, Homme and Evans, as an example have investigated operant technology in animal lab experiments and found that it has applicability in the classroom. They have developed instructional procedures like contingency management programs with "reinforcement menus", which provide a data based strategy guide for use by teachers.

SELECTION OF ASSESSMENT PROCEDURES

Fifth, the teacher must be able to evaluate changes in behavior relating to stated outcomes or competencies. Two components of evaluation, both related to instructional systems design, are discussed by Talmadge (1975).

> The first is concerned with a measurement of performance, that is, with providing a yardstick for determining the achievement of the specific learning objectives....Criterion references predict achievement on a predetermined mastery level. For example, the criterion for attainment of a specific objective...may be set at 90 percent accuracy. Successful performance can only be achieved by the learner who reaches this level. Because this form of measurement places learners in only two categories (mastery achieved or mastery not achieved) it tends to reduce competitiveness. Another form of criterion referenced measurement is the gain score (measuring achievement in terms of the individual's pre- and postscore progress).
>
> The second component of evaluation deals with the role of evaluation and the purpose of evaluation information as feedback to the program....Where the general program objectives in self-directed learning include active participation by learners, they shuld monitor their own progress and discover how to use the evaluation information to make decisions about their own learning. Such a system should provide built-in materials for self-evaluation and help the learner determine his own strengths and weaknesses (p. 39).

The determination of measurement criteria is very important in its potential effect on an individual students' motivation. If the standards are set too high, the student who feels incapable of attaining them will most likely become discouraged; low standards may cause the student to become bored and disinterested. The establishment of measurement criteria can be done according to performance data on proficient students in the class, an ideal model (e.g., the oral reading rate of a newscaster), or data established by documented programs in the same instructional area.

ORGANIZATION OF INSTRUCTIONAL SEQUENCE

Sixth, the teacher should be able to prescribe the next instructional step for each student who has completed an objective or cannot achieve an objective. Decisions about instructional sequences can often be transfered from one student to another, and after a time, may become very routine. Students can often become involved in the decision making.

Glaser and his colleagues (1975) discuss the progress of students through a sequence of one individualized learning reading program (see Figure 1 for an illustration of their description).

> The student begins the sequences with a cassette-led lesson designated A, follows with the correlated A-form workbook exercises, and then interacts with the teacher on a progress check. If his performance is satisfactory, the student leaves the prescriptive situation and selects his next activity from two possibilities at his level....Both activities require the child to answer questions about what he chose to read, and both incorporate the new content introduced in the prescriptive materials just encountered, while cumulatively maintaining earlier content.
>
> If the student's performance is not satisfactory, the teacher will prescribe the cassette-led lesson designated B. The B-form cassette and correlated workbook pages are essentially the same in instructional techniques as the A-form, but provide another teaching instance using different examples. After the student completes the B-form exercises, the teacher administers Progress Check B. Once again, if performance is satisfactory on the check, the student then selects his next activity. But, if performance is unsatisfactory, the teacher must choose one of two prescriptions. One possible choice is to recycle the student through the A-form material again....The other possible prescription

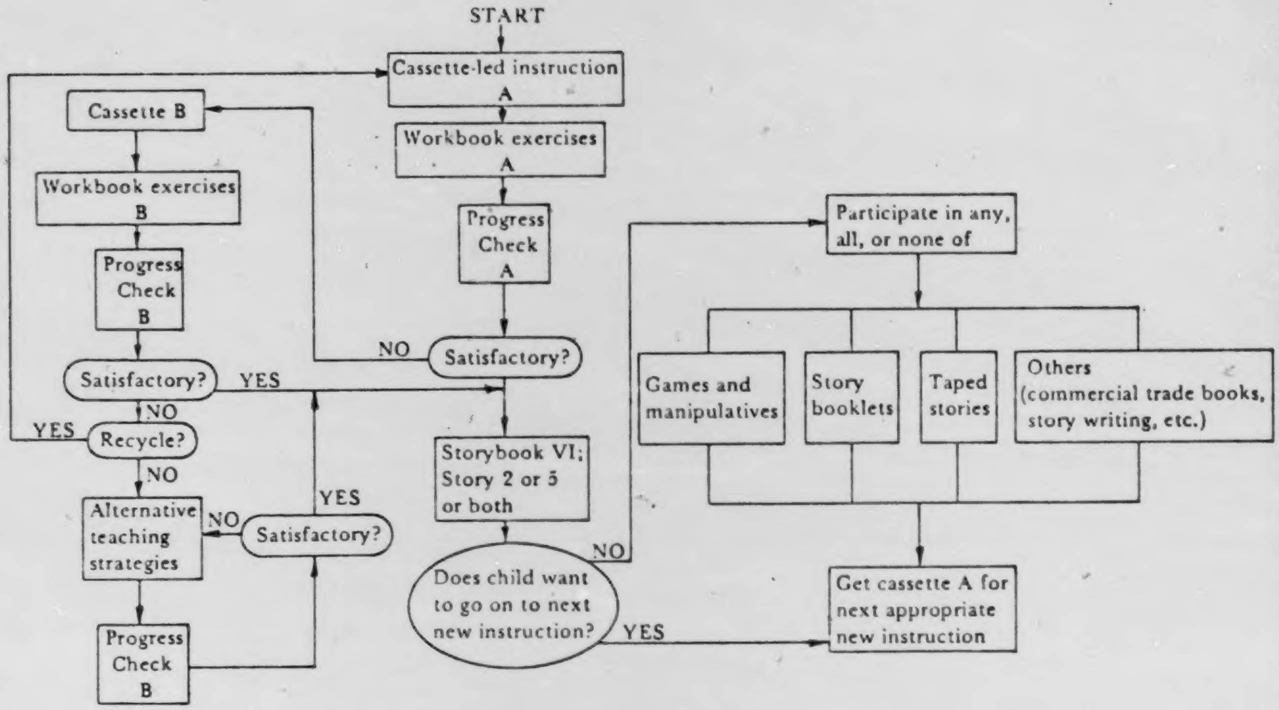

START
Cassette-led instruction A
Workbook exercises A
Progress Check A
Satisfactory?
NO
Cassette B
Workbook exercises B
Progress Check B
Satisfactory?
YES
NO
YES
Recycle?
NO
Alternative teaching strategies
NO
Satisfactory?
YES
Progress Check B
Storybook VI; Story 2 or 5 or both
Does child want to go on to next new instruction?
NO
YES
Participate in any, all, or none of
Games and manipulatives
Story booklets
Taped stories
Others (commercial trade books, story writing, etc.)
Get cassette A for next appropriate new instruction

Figure 1

Flow chart of the NRS instructional sequence

(Glaser and Rosner, 1975, p. 103)

> that the teacher may make is to enter the child into alternative teaching strategies. When the student performs satisfactorily on Progress Check B, he will return to the selection of either Story 2 or Story 5 as his next activity.
>
> When the student completes the activity he selected, he enters the third situation, his own choice. As shown on the chart, the student decides if he wants to perform some of the horizontal activities or move on to the next instruction (Glaser and Rosner, 1975, p. 102).

REVIEWING AND EVALUATING THE INSTRUCTIONAL PROGRAM

Seventh, teachers must be able to monitor student progress toward the stated outcomes, and determine the general effectiveness of the strategies used. Reporting systems that provide information about outcome and competency attainment, and the methods that were used for diagnosis, prescription and assessment will be most useful. Parents, students, and the instructional staff (e.g., teachers, counselors, and principals) can benefit from frequent, timely and complete progress reports.

Outcome Based Instruction

Competency Based Education, as defined by Schalock et al. (1976, pp. 18-23), calls for instructional models capable of assessing whether a student's behavior has actually changed in accordance with stated outcomes. The purpose of competency based instructional models is to effectively increase the attainment of stated outcomes. However, as Popham states below, they are too often considered an end in themselves (i.e., the use of a model will be considered valuable, whether or not it has actually improved the attainment of objectives).

> In contrast to goal-referenced instructional models, we find an increasing number of instructional schemes which are essentially means-referenced. For example, considerable attention given in recent years to the interaction analysis model (Flanders, 1965) is illustrative of this paradigm. The concern of such models is with the means of instruction and whether or not a particular set of instructional processes is used....There may or may not be an implication of which means are desirable in these models, but the instructional means, not ends, remain the important commodity. Frequently, these means are never justified in terms of whether they produce increasingly effective attainment of ends; it is considered sufficient that the means are acceptable (p. 38).

This discussion focuses on outcome based — in contrast to means based — instructional approaches. Although means based instruction should not necessarily be excluded from competency based programs, CBE requires that the results of instruction be measured; this measurement will be facilitated if instructional activities are systematic.

Selecting Effective Strategies

The seven basic teacher roles described in an earlier section relate to both outcomes and any life-related competencies subsumed within those outcomes. Methods of instruction related to CBE may differ. The life-relevant characteristics of competency statements may imply the need for instructional strategies that incorporate experience based instruction through simulated real-life situations or out-of-school activities. They may also suggest the need for a diagnostic and counseling program to help students identify strengths and weaknesses related to the competencies, and design a sequence of learning experiences that will address their needs.

A variety of instructional strategies can be implemented that relate to life relevant competencies. Glaser and Rosner (1975) describe one:

> To enable children to engage in reading situations that resemble real-world reading situations, NRS designers have developed three categories of materials. The first, the prescriptive category, is essentially controlled by the teacher [see Figure 1]. The second, the student selection category, affords the students the opportunity to select activity A or activity B. And the third, the choice category, arranged by level rather than sequence, allows the child to choose from a variety of materials and activities (p. 100).

Effective Strategy Utilization: An Example

One high school in Seattle implemented a competency based instructional program in business education. Their approach to the basic job-related competencies demonstrates the effective incorporation of real life situations into instructional strategies.

Seniors who are completing the secretarial program meet in a seminar for two hours once every two weeks. Each session focuses on one or more job-related goals. Simulation and role playing strategies are used by the resource people in an effort to inject real-life experiences into classroom activities. Each seminar group includes a teacher, a business person, students who have had real work experience, and students who are still looking forward to work experience.

In conjunction with the seminar, each student spends two weeks working full time on a job in the business community. Each work experience is structured so that the student must apply the knowledge and skills mastered within the conventional instructional program. This process enhances learning transfer from classroom to the job. Students are supervised by the employer, who agrees to help the student develop or enhance whatever competencies are the focus of the work experience. The employer provides instruction and evaluates student performance. After two weeks, the student returns to the seminar and relates the experience to the group. As a result of the seminar and work experience, students increase their job skills, practice the transfer of learning experiences to the "real world", and increase their confidence about working in the business community.

Alternative Outcomes Based Instructional Models

A wide variety of outcome based instructional models exist. The models which have been selected for discussion are somewhat consistent with CBE characteristics and would depart only if they proposed outcomes that did not reflect all the proposed attributes of CBE most likely in the areas of life-role relevancy and certification. The following models have been chosen for discussion:

- O D Prime Model
- Kibler, Barker and Mills Model
- IPI (Individually Prescribed Instruction)
- PLAN (Program for Learning in Accordance with Needs)
- IS (Individualized Science)
- IGE (Individually Guided Education)

O D PRIME

In 1968, Don Tosti and Lloyd Homme developed a classification model of the activities that they considered to be both necessary and sufficient to a formal learning environment. This model is called PRIME: Prescription, Instruction, Motivation, and Evaluation. Frieder (1970) added the activities of objectives formulation and diagnosis to the model and developed a system that he calls O D Prime.

- O = Formulation of objectives and learning activities
- D = Diagnosis of learner's instructional needs
- PR = Prescription of instructional activities for the learner
- I - Instruction of the learner
- M = Motivation of the learner
- E = Evaluation of the learner's degree of achievement of objectives.

Each of the components of this system works in conjunction with, and is dependent on, all of the others (Hankins, 1973).

Objectives Formulation. Tuckman (1972) describes the four components of a behavioral or performance objective as follows:

- Operationalization: Operationally define the aim of the task. Write in specific behavioral terms to include the use of an action verb. For example, upon completion of the program the student will be able to (1) identify, or point to something that has the following properties; (2) describe, or tell about those properties; (3) construct, or make something having the following properties, and (4) demonstrate, or use a procedure of a particular nature (p. 329).

- Content: Describe the specific content in which mastery or competence is to be shown. What is it that the student shall be able to identify? What is it that a student shall be able to describe? What is it that the student shall be able to construct? (p. 330).

- Exact Conditions: Specify the exact conditions under which the behavior is to take place. For example: Given a list of twenty items, the student shall identify, using the following pieces of equipment, the student shall construct or demonstrate (p.330).

- Criterion: Specify criterion such as the amount of time the student will have and how many correct responses he is likely to be able to make in that amount of time...(p. 331).

Diagnosis. The diagnostic process includes making an assessment of: the student's performance levels, learning styles an rates, attention span, physical health, and any other variable that might effect his learning. It may also include a consideration of the learner's current characteristics. Diagnosis includes the testing of abilities which may or may not be specified in the learning activity. Certain prerequisite behaviors must be mastered by learners before they can succeed in new learning experiences. For example, if reading ability is necessary in a learning module or activity, the student's reading ability would need to be assessed prior to the activity if his or her reading ability has not been established previously. The effectiveness of the teacher is enhanced when he knows where his students are in relation to where he wants them to be (Hankins, 1973, p. 365).

Prescription. The prescription process consists of selecting a set learning activities which are congruent with the strengths and weaknesses indicated by diagnosis and which are implemented to help the student reach the learning objectives. One child may profit most from listening to a recorded lesson, while another makes gains by reading a book or reviewing a film strip. Some students will need direct help from a teacher, or aide, or an educational specialist. Frieder (1970) puts it this way:

> Prescription, of course, depends on objectives and a diagnosis: the prescriber must know what constitutes good educational health for the learner - for example: what level of reading ability is desirable for him; and he must perceive the current state of the learner's educational health - for example: what level of reading ability he has already attained. He must then select the instructional unit that will take the learner from the diagnosed level to the desired level (p. 29).

Instruction. The instructional process is determined to a great extent by the objectives, the diagnosis and the prescription. The prescription should indicate what instructional activities are most appropriate for a given learner. The actual instruction will also include teacher presentations (formal or informal, lecture or discussion); media and technological aids (films, tapes, records, computers); programmed instruction, and field trips and other outside activities that might help the student acquire the objectives of learning.

Motivation. Frieder(1970) believes that motivation is the most neglected component of the OD PRIME System, because "attempts to implement research findings have linked motivation to a particular component rather than allowing it to function as a full subsystem." In other words, research findings have linked motivation to reinforcement alone, rather than considering other possible influences on motivation. In introducing alternative approaches to the problem of motivation, he states:

> Behavior theory assumes that all behaviors are learned responses. The environment in which a child is raised develops his behavioral repertoire by giving him "payoffs" or rewards for certain behaviors. Peers, for example, pay off an individual by giving him status; peer-status may reinforce getting good grades, or it may reinforce school avoidance. Generally peers

> reinforce what has been promoted as appropriate behavior by adults. Parents may orally reinforce consistent job-attendance behaviors at the same time that their actions reinforce get-by-on-the job behaviors. Other adults may condemn a child's escapism while exhibiting it themselves on a daily basis in front of the television set. Oral reinforcement quickly wears thin in the face of contrary adult behavior (p. 31).

The solution that Frieder suggests to the problem of inconsistent reinforcement is contingency management - a system of managing the learning environment so that rewards are contingent upon the execution of certain behaviors.

Evaluation. The final process in the OD PRIME learning environment will reveal whether or not diagnosis, prescription and instruction are resulting in student achievement of the objectives. The trend toward stating objectives in behavioral terms has greatly increased the importance of evaluation. The evaluation can determine whether the learner needs to re-enter the learning module, perhaps with some modification in instructional activities, or whether the objectives or performance criterion need to be revised.

KIBLER, BARKER AND MILES MODEL

Kibler, Barker and Miles (1970) have suggested a model of instruction for use in helping students achieve stated behavioral objectives. Their model includes ten components:

- Prelearning preparation: Teachers should prepare students for new learning experiences by telling them what previous behaviors will be helpful or harmful, prOviding them with an appropriate "set" for what is to follow.

- Motivation: Students learn more efficiently if they want to learn. This desire can be fostered through systematic application and scheduling of reinforcement related to learning activities.

- Terminal Performance Model: Complex skill learning can be very difficult; shaping procedures that depend only on reinforcement may be inadequate. The more complex skills can be learned much more quickly through a demonstration of the correct required performance previous to student activity.

- Active Response: While watching someone else may help to speed-up the learning process, proficiency is only attained after one performs the act either overtly or covertly.

- Guidance: When teachers demonstrate new behaviors to be learned, they should guide and prompt the students so that many efforts and undesirable associations can be prevented.

- Practice: Learners should be given opportunities to practice their learned behaviors. Practice will facilitate adaptation to the extent that the practiced behaviors are similar to behaviors required in the future.

- Knowledge of Results: Practice is not sufficient of and for itself it should be accompanied by knowledge of results. Feedback will influence behavior to the extent that it tends to encourage or discourage the desired behavior.

- Graduated Sequence: Subject matter should be organized in a heirarchial form from the simplest to the most complex. Tasks should be arranged whereby the learner progresses from the familiar to the unfamiliar in steps that are not so large as to prove debilitating nor so small as to provide no challenge.

- Individual Differences in Rates and Modes of Learning: Because students learn at different rates, their learning experiences should be structured to provide each individual with a suitable rate. Modes of instruction may also influence student rates of progress. It is, therefore, important to select the teaching mode which will best encourage an individual to learn.

- Classroom Teaching Performances: The requisite skills of effective teaching (stimulating interest, managing the classroom, and identifying and administering reinforcers) are difficult for teachers to learn. Research is constantly being conducted to expand the data base on which teaching skills are built.

IPI (INDIVIDUALLY PRESCRIBED INSTRUCTION)

In 1969, Cooley and Glaser hypothesized that the most important aspect of the application of computer technology in the school setting would be to individualize instruction. They based this prediction on their belief that any suitable effort to improve instruction must be based on a model of learning and instruction. The model that they designed has the following attributes:

- A statement of the learning objectives as observable student behaviors.
- An instructional sequence that begins after the student's capabilities (relevant to the instructional objectives and program) have been assessed.
- Provisions for student choice of alternative models of instruction.
- Plans to continually monitor and assess each student's performance.
- Instruction that proceeds according to sequence, commensurate with the student's performance to date, and is flexible enough to allow for available alternatives.
- Performance data, used in conjunction with other data, to monitor and improve the entire system.

PLAN* (PROGRAM FOR LEARNING IN ACCORDANCE WITH NEEDS)

The program for Learning in Accordance with Needs is a multimedia approach to individualized instruction in reading and language arts, mathematics, science, and social studies. The PLAN* instructional unit provides learning objectives, recommended learning activities and criterion tests. A guidance system relates the performance data of an individual student to the appropriate number and type of activities available in the instructional package.

A computer records information on the performance of PLAN* students, which can be processed to provide: feedback to students, progress information to teachers, and management information to program planners. PLAN* offers a training program for administrators and teachers so that existing personnel can provide the counseling and classroom management required by the system. (Flanagan et al. 1975, pp 136-137).

IS (INDIVIDUALIZED SCIENCE)

Individualized Science (IS) provides K-12 personalized instruction that will give students the necessary knowledge and skills to cope with rapid advances in science and technology. The instructional program provides students with opportunities to:

- Practice self-initiation and self-direction.
- Coevaluate the quality, extent, and rapidity of their learning.
- Display positive attitudes toward the scientific enterprise.
- Obtain skills in scientific inquiry.
- Acquire scientific literacy.

The IS program is structured to provide the following information at the specified grade levels:

Elementary:	introduction to, and practice in, the processess of scientific inquiry, exploration of the areas of science.
Intermediate:	application of scientific processes in problem solving; accumulation of information.
Secondary:	scientific inquiries with unknown answers to help students acquire new concepts, principles, and insights.

The IS program provides various types of learning resources, listed in Figure 2 and recommends that students participate in their selection.

IGE (INDIVIDUALLY GUIDED EDUCATION)

Individually Guided Education (IGE) provides another alternative to age-graded progress systems. The seven major components (Figure 3) are coordinated to provide the individual student with a programming model (Figure 4). This model can respond to individual performance levels, rates of progress, learning styles, motivation and other student characteristics. It provides programming in the cognitive, psychomotor and affective domains and can be used with both explicit and general educational objectives (Klausmeier, 1975, p. 55).

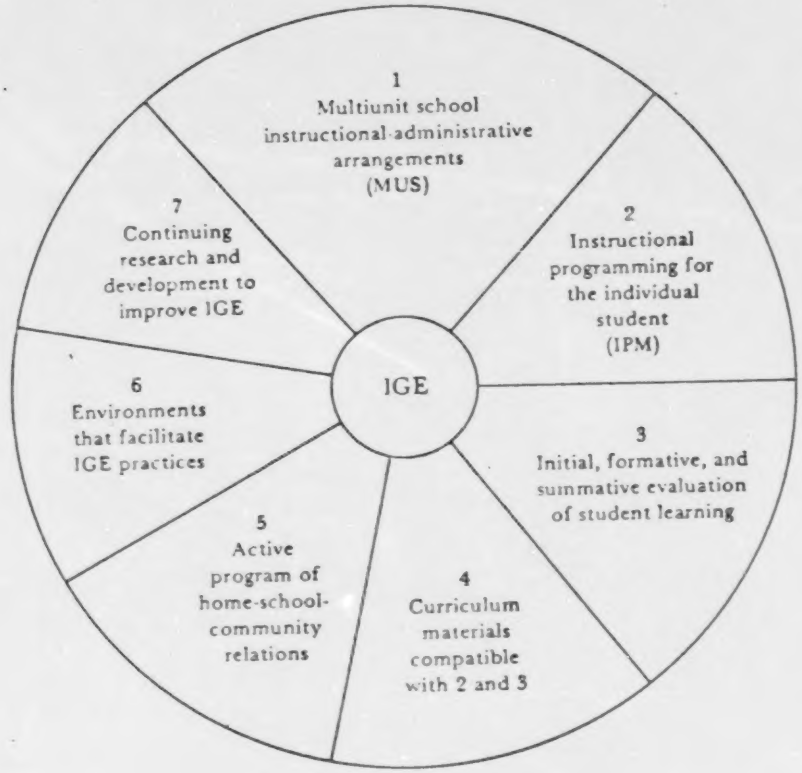
Figure 2
Learning resources that contribute to the goals of IS

Learning resources	Goals				
	Student self-direction	*Student co-evaluation*	*Affective*	*Inquiry*	*Scientific literacy*
Individual lesson		X		X	X
Individual taped lesson				X	X
Men and ideas filmstrip			X		X
Miniexploration	X	X	X	X	X
Readings in science		X	X		X
Directed group activity			X	X	X
Student seminar		X	X	X	X
Student activity	X	X	X	X	X
Invitation to explore	X	X	X	X	X
Self-initiated independent activity	X	X	X	X	X
Science learning game			X	X	X
Science notebook	X	X		X	X
Planning booklet	X	X			
Keys book	X	X			
"How to . . ." booklet	X			X	

(Glaser and Rosner, 1975, pp. 104-107).

Figure 3

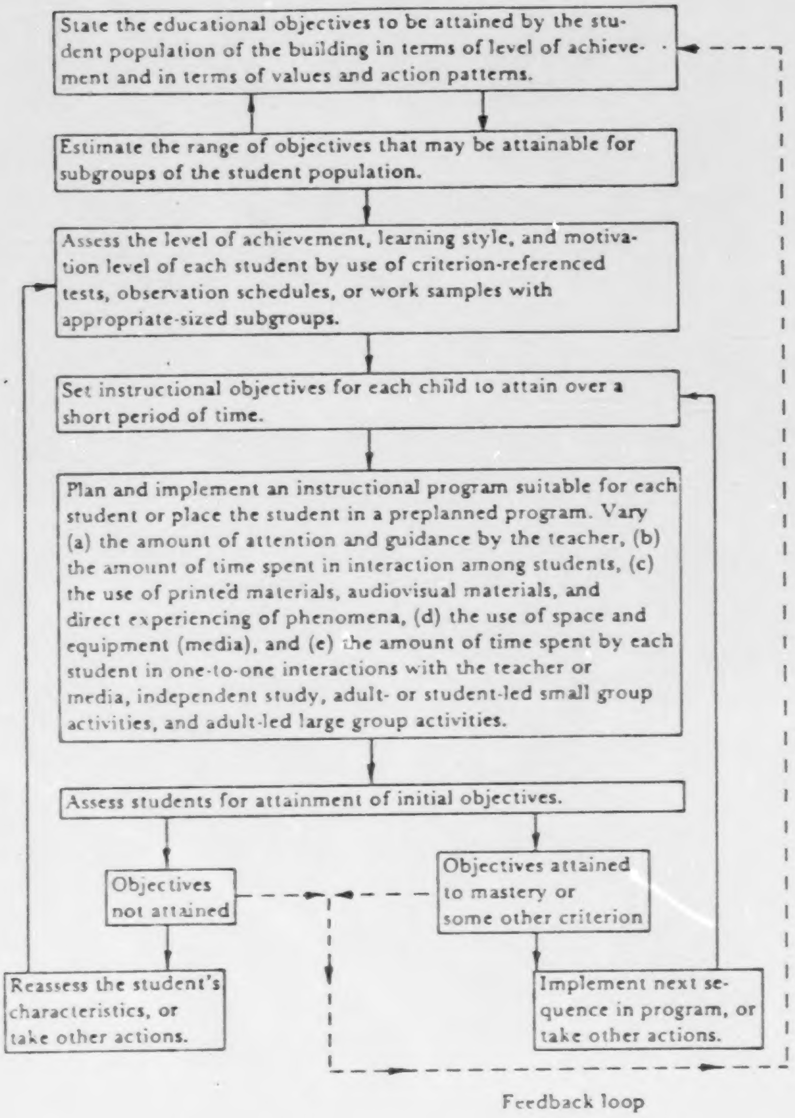
Seven Major Components of Individually Guided Education


1
Multiunit school instructional-administrative arrangements (MUS)
2
Instructional programming for the individual student (IPM)
3
Initial, formative, and summative evaluation of student learning
4
Curriculum materials compatible with 2 and 3
5
Active program of home-school-community relations
6
Environments that facilitate IGE practices
7
Continuing research and development to improve IGE
IGE

(Klausmeier, 1975, p. 50)

Figure 4

Instructional Program Model for Individually Guided Education



State the educational objectives to be attained by the student population of the building in terms of level of achievement and in terms of values and action patterns.

Estimate the range of objectives that may be attainable for subgroups of the student population.

Assess the level of achievement, learning style, and motivation level of each student by use of criterion-referenced tests, observation schedules, or work samples with appropriate-sized subgroups.

Set instructional objectives for each child to attain over a short period of time.

Plan and implement an instructional program suitable for each student or place the student in a preplanned program. Vary (a) the amount of attention and guidance by the teacher, (b) the amount of time spent in interaction among students, (c) the use of printed materials, audiovisual materials, and direct experiencing of phenomena, (d) the use of space and equipment (media), and (e) the amount of time spent by each student in one-to-one interactions with the teacher or media, independent study, adult- or student-led small group activities, and adult-led large group activities.

Assess students for attainment of initial objectives.

Objectives not attained

Objectives attained to mastery or some other criterion

Reassess the student's characteristics, or take other actions.

Implement next sequence in program, or take other actions.

(Klausmeier, 1975, p. 56.)

Summary

This section explores the alternative methods for outcome and competency instruction. At the outset, six properties commonly found in a CBE instructional program are presented. These properties help to set lines of demarkation which narrow the field of teaching technologies amenable to CBE. Then this section presents the seven basic activities for teachers as defined through the Oregon Minimum Standards for Public Schools as well as writings of various authors. These seven activities are:

- Defining measurable outcomes
- Diagnosing individual needs
- Selecting instructional strategies
- Arranging the learning environment
- Selecting assessment procedures
- Organizing instrutional sequences
- Reviewing and evaluating the instructional program.

A presentation of six CBE compatible instruction models follows. These models are to a great extent built upon research and data related to learning and developmental theories.

This paper has thus far addressed the state of the art of Competency Based Education in the areas of outcome and competency identification and instructional methods.
The next section will explore alternative methods for outcome and competency assessment.

ALTERNATIVE METHODS FOR OUTCOME AND COMPETENCY ASSESSMENT

The Characteristics and Functions of Assessment

An integral component of competency based education is continuous adaptation and improvement through the use of data relating to student performance, program operation and staff performance.

In the previous section, in the course of the discussion of assessment related aspects of CBE teacher activities and instructional models, a number of "alternative methods for assesment were discussed. These alternatives included varying the time, place, participants, and nature of the assessment effort. In this section, greater attention will be paid to some of the more technical alternatives for CBE assessment.

Levels of Assessment

Assessment of student and program performance may occur at different levels. The first level involves assessment procedures that determine individual pupil progress through a series of instructional units. At this level of assessment, the data influence the diagnostic and prescriptive decisions that are used to assign or negotiate learner activities and to select the appropriate level of complexity. Individual student assessment in CBE allows flexibility in learner progress rates, and provides means of comparing an individual level of attainment with some standard of achievement.

At the second level, the assessment process changes in focus. The second level concerns group performance. The unit of analysis may be a classroom, all students at a particular grade level, or students within a particular school, and district or state educational system. The primary concern at this level is to obtain evaluative data which is either formative or summative in nature. Formative data is employed in an identification process to ascertain where the instructional process may be weak or ineffective. Summative data indicates whether or not the learner has achieved the ultimate objectives that have been set in advance. These types of data allow comparisons among, for example, school districts or individual schools. These data are used as the basis for descriptions of and comparison among groups, rather than as a basis for individual diagnosis or prescription.

Kinds of Assessment

Test specialists in education commonly use four approaches to student assessment:

- Norm referenced testing (NRT)
- Criterion referenced testing (CRT)
- Objectives referenced testing (ORT)
- Domain referenced testing (DRT)

These four kinds of testing are described and compared by Sanders and Murray (1976) as follows:

> Norm referenced testing (NRT). Performance on a task is interpreted by referencing the performance of others. Example: Local norms, in the form of a distribution of test scores, have been developed for a district over the past two years. Johnny's test score was at the 90th percentile of that distribution, so we conclude he is doing better than about 90 percent of the children in the district.
>
> Criterion referenced testing (CRT). Performance on a task is interpreted against an absolute standard without referencing the performance of others. Example: The standard for good performance is getting at least 80 percent of the test items correct on the criterion referenced test. Johnny got 85 percent of the items correct so we conclude he is performing acceptably.

Domain referenced testing (DRT). Performance on a task is interpreted by referencing a well-defined set or class of tasks (a domain). Example: We have selected a random sample of 10 test items from a pool of 100 items for basic fifth grade spelling. Johnny spelled nine out of 10 words correctly so we estimate that if tested over and over again he would be able to spell 90 percent of the spelling words correctly.

In summary, norm referenced testing involves giving meaning to a test score for an individual or group by comparing it against the scores of others taking the same test. Interpretations are based on relative performance. Criterion referenced test scores gain their meaning by comparing the scores against absolute standards for individual or group performance set up by the interpreter. Objectives referenced tests yield scores on each objective covered by the tests that are used to draw conclusions about group or individual performance domain referenced tests provide scores that are estimates of a group's or individual's likely performance on a similar set of items.

Sanders and Murray (1976) also discuss the following concerns regarding selection and use of tests: key emphasis, development procedures, item selection, necessary input for the test development process, the types of scores reported, examples of test interpretation, recommended uses, and inappropriate uses and limitations. This discussion is summarized in the table below, which was originally presented in their article.

Table 1

A Comparative Analysis of Basic Achievement Test Development Approaches

	Classes of Test Referents			
Characteristic	**Norm**	**Criterion**	**Objectives**	**Domain**
1. Definition/Interpretation	Test performance as compared against others on the same test.	Test performance as compared against absolute standards.	Test performance on behaviorally stated objectives.	Test performance as an estimate of performance on a universe of similar items.
2. Key Emphasis	Maximize individual differences. Survey of generally accepted skills and knowledges. Items logically sampled, then sorted, from generally defined content area. Evaluation results.	Explicit standards used for interpreting test performance. Items taken directly from specific curriculum. All items for unit used—no sampling. Evaluative results.	Use of behaviorally stated objectives to describe types of desired behaviors. Test items prepared for priority areas of concern. Items judgmentally sampled from all possibilities. Descriptive results.	Explicitly defining content area of test. Creation of item pools or item forms. Developing estimates of performance over a large number of similar items. Items randomly sampled from domain. Descriptive results.
3. Development Procedure	1. State content area. 2. Test items developed to discriminate. 3. Norms developed. 4. Appropriate validity and reliability estimates documented.	1. Curriculum or content analysis. 2. Test items written to match analysis in form and content. 3. Standards established.	1. Objectives stated and selected. 2. Test items written to match objectives in form and content.	1. Content limits provided. 2. Item forms established. 3. Sample items written. 4. Sample of items drawn from domain.
4. Item Selection	Sample on a logical basis from theoretically defined content. Select items that discriminate.	Use items that replicate behaviors called for in specific instruction.	Use items that are indicators of achievement of objectives of interest.	Develop item forms for specified domains. Draw a representative sample of all items that could be generated using an item form.
5. Necessary Input for the Test Development Process	Knowledge of a curriculum content area or a construct on which students can be expected to differ.	Performance objectives which include an acceptable level (standard) of performance.	A statement of objectives in terms of student behavior.	A content domain either explicit in a curriculum or explicitly stated in the form of objectives.
6. Types of Scores Reported	1. A percentile rank. 2. A standard score. 3. A stanine score (a special case of standard score). 4. A grade equivalent score.	1. A statement of whether or not a student has achieved a predetermined percentage or number correct. 2. A statement of whether or not a group of students has (on the average) achieved a predetermined level of performance. 3. The time taken to perform a given task and an indication of whether or not the task was completed in the allotted time.	1. Number of correct items for a student. 2. Percent correct for a student. 3. The percentage of students in a program who pass each item.	1. The percentage of correct items for a student *and* an estimate of the percentage of items that a student could get correct in a universe of items.
7. Example of Test Interpretation	"You can perform better on this test than approximately 79 percent of the children in the group against which you are being compared."	"You have answered 80 percent of the items for this unit correctly so you may move on to the next unit."	"You have gotten 3 out of the 4 items written for this objective correct."	"You have answered 90 percent of the items correctly so we estimate that you will answer about any 9 out of 10 similar items correctly."
8. Recommended Uses	1. Selection. 2. Classification.	1. Progress in specific curriculum.	1. Gathering some information about priority areas.	1. Instruction or education.
9. Inappropriate Uses and Limitations	1. Not for program or curriculum evaluation. 2. Not for frequent use in instruction.	1. Not for cross-curriculum testing. 2. Not for discrimination (selection, classification).	1. Not for comprehensive coverage of instruction. 2. Not for discrimination (selection, classification).	1. Can be expensive to set up. 2. Not for discrimination (selection, classification).

Achievement tests can also be classified as mastery tests, standardized tests and traditional tests. Each implies somewhat different concerns. Standardized is used as a descriptor of tests with norms. To some, however, the term standardized may imply that the test (1) has been published, (2) has been normed, (3) has explicit instructions and administration, and/or (4) was constructed to meet technical standards. Hocker et al. (1975) describe some of the sources of confusion in distinguishing between norm and criterion referenced tests.

> Norms
>
> Creation of norms for a criterion referenced test is entirely possible. Just because the test is built to be directly interpreted relative to some performance standards does not preclude its also having norms and being used for program evaluation. This may be a reasonable procedure. However, since the test has probably been designed to be used for instructional planning and guidance, it is likely to be useful for other purposes. In any case, the existence of norms does not make the test a norm referenced test. Fortunately, this source of confusion is rare.
>
> Criterion
>
> Analogously, one may define some score on a test constructed to be norm referenced as the criterion score indicating mastery. Since the breadth of the scale usually makes this decision arbitrary and not something others would automatically understand, it merely creates confusion to say that this makes a test criterion referenced. This sort of confusion is widespread and is complicated by the difficulty entailed in specifying the breadth of an objective or its domain. The comments of those who take this position indicate that they really maintain that all tests are alike and ultimately must be norm referenced. This position is contradicted by the common sense interpretation used by many teachers with their own classroom tests (Hocker and others, (1975).

Because individual student assessment is central to competency based education, special attention is given to the characteristic similarities and differences between norm referenced and criterion referenced achievement tests. Hocker et al. (1975) distinguish these two testing approaches on the basis of content specification, item writing specification, desirable item characteristics, administration, scores, score distribution, reliability, content validity, construct validity, criterion related validity, and uses. They summarize the similarities and differences between norm and criterion referenced testing. (See Appendix H).

Effective student assessment requires correct use of both types of testing. Norm referenced tests provide data for group decisions. Criterion referenced tests, however, are most amenable to individual diagnostic/prescriptive decisions.

Individual Student Assessment

While competency based education emphasizes an outcome component, what the student is to learn, it also involves strong emphasis on the means used to achieve the desired outcomes. In order to assure a dynamic ongoing program, there must also be emphasis on both student and program diagnosis and prescription. This important adjunct to the CBE approach must specify how testing data will be used to:

- Evaluate progress within an instructional unit
- Evaluate terminal performance at the completion of that instructional unit
- Continuously update the instructional unit, incuding the instructional techniques and products in use.

Individual student assessment is a critical part of the diagnostic/prescriptive process. The data obtained during this phase of the instructional process assist **progress feedback as well** as identification of needs. Ultimately these data can be employed to evaluate the programs, techniques, products, and competency categories.

Criterion referenced testing provides a rich resource which enables teachers and students to assess both the progress and results of instructional efforts.

CRITERION REFERENCED TESTS FOR ASSESSING INDIVIDUAL STUDENT OUTCOMES AND COMPETENCY ATTAINMENT

Underlying the problems of measurement, evaluation and assessment is the absence of a properly developed system of goal and objective formulation within the nation's school systems. The appropriateness or validity of any particular measurement and evaluation instrument is directly dependent upon its consistency with the goals and objectives of the educational system in which it is to be used (Doherty and Hathaway, 1973).

In a competency based education program, the development or choice of criterion referenced tests used to evaluate student outcome and competency attainment is influenced by the same variables that influence the identification of outcomes and competencies.

Alternative measurement methodologies would be expected in proportion to the amount of flexibility exercised by the governing authority. Flexibility refers to the amount of autonomy that the authorities grant to the lower levels of the hierarchy. Just as the authority level had influence on the identification process, so too does it on the measurement process since the very tenets that governed identification may in part also govern measurement. In Oregon, while the state mandated the CBE program, the local school districts are responsible for the identification, measurement, implementation and recordkeeping phases of CBE. Many of the local districts have granted decision-making autonomy to the individual schools and thus to the teachers.

Since the same teachers who are instrumental in the identification of outcomes may develop or choose an assessment tool, then the influence which governed their outcome selection may influence assessment selection as well. In Oregon, there are established outcome and competency guidelines (see preceding section) which direct the assessment process. There may, however, be variation within these guidelines in keeping with the particular governing persuasion of individual teachers. Here variability or alternative methodologies would be expected to the degree that the teachers were influenced by research data, intuition or existing content. As an example, a teacher who may be influenced by the research of Jerome Bruner, Hilda Taba and Benjamin Bloom would perhaps select or design an assessment tool that was reflective of the author's research findings. Perhaps the objectives of such an approach would be governed in part by:

- Bruner's Learning Principles
- Bruner's Discovery Learning Tenets

- Taba's Hierarchy in Concept Development
- Bloom's Hierarchy of the Cognitive Domain

The subsequent assessment product might require:

- Assessment in the cognitive domain and perhaps also in the affective and psychomotor domains
- Assessment at concrete and abstract levels
- Free and frank responding by the students rather than requiring a predetermined "right" answer
- Fostering student spontaniety which may reflect the level of student's cognitive ability or cognitive style.

If on the other hand, if an individual teacher were influenced by the research of Robert Gagne' then the selection or design of an assessment tool might reflect that bias. Perhaps the objectives of such an approach would be governed by:

- The five major categories of human capabilities that are viewed as outcomes of learning
  1. verbal information
  2. intellectual skills
  3. cognitive strategies
  4. attitudes
  5. motor skills
- A knowledge of the eight conditions of learning to insure that the assessment does not require student capabilities that have insufficient prerequisite foundations.
- An understanding of the eight phases of an act of learning where phases five through eight direct the asssessment sequence:
  1. motivation
  2. apprehending
  3. acquisition

4. retention

5. recall

6. generalization

7. performance

8. feedback

The subsequent assesment might require:

- Demonstrated performance in any or all capability areas

- A "Right" answer to assessment probes which would hold at all condition levels

- Emphasis on the terminal response with lesser or no emphasis on the processes employed through the task. Little credance placed on process verbalization or introspection

- Demonstration of performance somewhat removed from target learning to assess generalization and transfer.

If a teacher were to be influenced by the developmental theory of Jean Piaget, the selection or design of an assessment tool might likewise reflect that influence. The objectives of such an approach would be governed in part by:

- A knowledge of Piaget's stages of development to insure that the assessment does not require the student to perform cognitive operations at a level which has not been reached.

Since Piaget's theory is sometimes interpreted as strongly supportive of discovery learning, the assessment product may be similar to the one influenced by Bruner and Taba.

By and large, the same rules that would govern competency identification would also govern the measurement and the recordkeeping techniques.

Life Roles and CBE

Oregon and some other states have a very strong life-role component in their CBE Programs and as such require measurement techniques that reflect life-role domains. Normally, students are assessed via pencil and paper tests. However, the predictability index of pencil and paper tests to life role success is tenuous at best. More germain to the preditability index would be assessments that more closely reflected the real life settings in which students would ultimately be expected to perform.

Clearinghouse for Applied Performance Testing (CAPT)

CAPT, a program administered through the Northwest Regional Education Labortory, defines applied performance testing (APT) as the measurement of performance in an actual or simulated setting. In competency based education, such tests focus on tasks significant to a student's life roles (e.g., consumer, producer, family member). Applied performance tests have two distinct requirements: (1) that the task actually be performed; and (2) that the task be realistic and authentic.

APTs can be categorized according to authenticity in either the stimulus or response mode. Such tests are appropriately applied in instructional settings where the desired outcome is the ability to perform a task or set of tasks.

Applied performance testing has been used in settings where movement toward a CBE system is desired. Sachse et al. (1975) have suggested that applied performance testing be used to redirect curricula toward an outcome oriented instructional process. In this context, applied performance tests have been employed in assessing student outcomes. Areas in which applied performance tests have been used include —

(a) Minimal life skills acquired from classroom learning. Two common examples are listed below.

Consumer Math	Functional Literacy/ Communication Skills
• Balancing a checkbook	Reading and comprehending a newspaper, lease, want-ads.
• Filing a tax return	Interpreting advertisements, editorials, political speeches.
• Computing (from gas mileage to product selection in a grocery store.)	Requesting written or verbal job information or communicating with a congressman.

(b) Occupational skills for certification or selection purposes.

(c) Psychomotor skills, including speaking a foreign language, conducting laboratory experiments, driving a car and participating in arts or sports activities.

By definition, applied performance testing requires that either the stimulus or response mode of the test be actual or simulated. In many cases, close adherence to this requirement necessitates the use of special manipulatives or settings. The best way to measure a student's ability to make change, for example, is to place the student in an actual situation where that behavior is to occur. The potential problems of such an approach become immediately apparent: only a few students can be tested at one time, the expense of testing is increased, and special materials are required. These problems suggest several questions.

- Is it feasible to test all students at all grades using applied performance tests?

- Can one-to-one or small group testing methods be streamlined to minimize time and expense?

- Are there ways to reduce costs by simulating tasks through paper and pencil tests?

- When must true applied performance tests be used, and when can there be less adherence to the applied performance mode?

- Must all students be tested in an applied performance mode, or can such testing be limited to a smaller group?

In a CBE system, individual certification of competence is required. Individual applied performance testing would therefore be required to establish such competence; mass testing in a less authentic situation would be acceptable only if individual competence did not need to be established. The expense of conducting applied performance testing must be weighed against the validity of the data that such testing requires.

Applied performance testing can be readily integrated into a competency based education system. As a comparison of concept definitions illustrates, the inherent qualities of CBE testing and applied performance testing are remarkably similar:

Competency based education has been formally defined as:

> ...a process that facilitates with a known degree of effectiveness, the attainment by learners of a specified level of performance on desired outcomes, including the ability to perform tasks related to success in life roles (Oregon Competencies Program, 1976).

Applied performance testing has been defined as

> ...the measurement of performance of some task significant to a student's life outside the school and/or to adult life. Such a task is valued as output for public schools. The testing device must allow for measurement of the task in an actual or simulated performance setting (CAPT Newsletter, 1974).

The critical component in each definition is the requirement that learners/examinees perform required tasks in nonacademic contexts. But despite this similarity, there are differences. The formal definition of CBE is broader, allowing for both instructional and student evaluation activities. The definition of APT is necessarily limited to the measurement of student outcomes specify. APT is best suited for assessing students' competence in a learning environment "where the end product of instruction is a performance."

A CBE system provides an environment structured to foster acquisition of life skills and other important educational outcomes; APT allows for evaluation of students' progress toward or realization of these competencies. Used in concert, these educational strategies could enhance the utility and meaningfulness of public education.

Criterion Referenced Tests

The ERIC Clearinghouse on tests, measurement and evaluation is developing a collection of criterion referenced tests (CRT's). The CRT's described in Appendix I typify the variety of tests available from ERIC under the rubric criterion referenced. For brevity, information on these CRT's is limited to descriptions and excludes information on administrations, format, response mode, and scoring.

Instructional Objectives Exchange (IOX)

IOX, a nonprofit educational corporation, provides educators with resource materials for making instruction more effective. IOX was initially established in 1968 under the auspices of the UCLA Center for the Study of Evaluation. As a source of instrumentation, IOX has developed a series of criterion referenced tests useful in diagnosing individual learners' deficiencies, targeting instructional improvement, and evaluating programmatic instructional efforts.

Among the materials currently available from IOX are tests in the following areas:

(a) Reading
- Word attack skills (K-6)
- Comprehension skills (K-6)

(b) Language Arts
- Mechanics and Usage (K-6)
- Word Forms and Syntax (K-6)
- Composition, Literature, and Literary Skills (K-6)

(c) Social Studies
- American Government (10-12)

(d) Mathematics
- Sets and Numbers (K-6)
- Operations and Properties (K-6)
- Numeration and Relations (K-6)
- Measurement (K-6)
- Geometry (K-6)
- Elements, Symbolism and Measurement (7-9)
- Geometry, Operations and Relations (7-9)

Criterion referenced test collections are being developed for language arts, social studies, and science. Many of the self-concept tests identified by CSE-RBS are also available from IOX.

The following are three documents concerning criterion referenced testing also, available from the ERIC Clearinghouse on Tests, Measurement, and Evaluation; Educational Testing Service, Princeton, New Jersey. These documents are described in TM News, No. 11, May 1973 put out by the ERIC Clearinghouse.

Curtis, H.A., Editor. The Development and Management of Banks of Performance Based Test Items.

Symposium papers presented at the 1972 Annual Meeting of the National Council on Measurement in Education are included. Each paper is concerned with banks of test items for use in constructing criterion referenced tests. Among the topics covered are locally produced item banks, commercially produced banks, and methods of computer storage and retrieval of test items. (ED 072 099; MF and HC, 36 p).

Hsu, Tse-Chi and Boston, M. Elizabeth. Criterion Referenced Measurement: An Annotated Bibliography

This bibliography is an attempt to assemble and annotate published and unpublished papers, studies, and related articles that have some bearing on criterion referenced measurement. The 52 items include data from 1913 to 1971 although the majority of them are very recent. (ED 068 531; MF and HC; 25 p.)

Keller, Claudia M. Criterion Referenced Measurement: A Bibliography.

This bibliography, prepared by the ERIC/TM lists 116 selected articles, research reports, monographs, books, and reference works related to criterion referenced measurement published between 1965 and 1971. It is limited primarily to material that deals directly with criterion referenced tests and testing procedures, and includes reports on computer-assisted test construction and the application of CRT's to individualized learning and instruction. (ED 060 041; MF and HC; 14 p.)

Summary

This section addresses the alternative methods for assessing outcomes and competenices. The methods reviewed are norm referenced tests, criterion referenced tests, objectives referenced tests and domain referenced tests. Included are examinations of the salient CBE implications of each method; and possible relations to assessment tools of the learning and development theories presented earlier

The discussion of the content, participants, timing, locus, and organization of CBE assessment begun in the previous section is continued. The section concludes with informaton on three sources of CBE compatible tests, the Clearinghouse for Applied Performance Testing (CAPT), The ERIC Clearinghouse on Tests, Measurement and Evaluation, and Instructional Objectives Exchange (IOX).

This paper has thus far addressed the state of the art of competency based education methods in the areas of outcome and competency identification, instructional methods and assessment procedures. For a complete CBE system, a fourth component is necessary, a competency based management system. It is to this component that the next section is addressed.

ALTERNATIVE METHODS FOR CBE INSTRUCTIONAL MANAGEMENT SYSTEMS

Each of the areas discussed in earlier sections of this paper is important individually, but assumes its fullest value as part of a totally integrated operating system. Stated outcomes and competencies are a basis for the development or selection of relevant measures of student achievement. Instructional strategies are selected and linked to appropriate outcomes. A monitoring system provides for data related to the appropriateness of the goals, the effectiveness of the instructional planning, instructional operation, and individual student achievement.

The general characteristics of a total[1] integrated instructional management system address needs related to outcome identification, measurement of outcomes, strategies for program development based on the outcomes, and strategies for outcome based instruction.

An Instructional Management System

Outcome and Competency Statements

The instructional management system should include an outcome and competencies component. This component can take the form of a resource collection (e.g., Tri-County Course Goals Collection) or outcomes of learning packages (e.g., PLAN* Teaching Learning Units). Computerized course goal retrieval systems have been developed on a regional basis and serve schools in and around Portland, Oregon; Seattle and Tacoma, Washington. These retrieval systems assist teachers, administrators and curriculum specialists in curriculum development and instructional planning. Through the system, goals can be retrieved under a wide variety of indicators, including terms related to discipline, grade level, subject matter, knowledge, process, and value-related characteristics and concepts.

Existing interrelationships among levels of a goal hierarchy should be identified. A sample goal structure is provided below

CURRICULUM AND INSTRUCTIONAL GOALS
(Cognitive and Affective)

System Level Outcomes

Each student should develop skills in reading writing, speaking, and listening. (Cognitive)

Program Level Outcomes

The student uses language effectively in interaction with others, gaining and improving skills in group communication processes. (Cognitive)

Course Level Outcomes

The student is able to use interpersonal communication to clarify his or her understanding of the assumptions and principles of others. (Affective)

Instructional Level Outcomes

The student knows ways to make complaints by phone courteously and concisely, including: identifying self and subject, speaking clearly and rationally, giving the other person time to respond. (Cognitive)

Student Level Outcomes

> Given a description of a situation where a complaint might be reasonably made, the student is able to role play the complaint in a courteous and concise manner to the 90% satisfaction of three trained observers. (Cognitive)

Instructional Strategies

The system should include a collection of alternative learning strategies related to the outcomes and competencies of the program.

Just as goals and measurement items are closely related, goals also become the basis for strategy selection. At the most general level, textbooks, major media resources and instructional programs should be selected on the basis of their pertinence to district, program and course level outcomes. The "SWRL Instructional Product Selection Kit" is one set of workshop materials that can help teachers, administrators and curriculum specialists make sound instructional materials selection decisions.

At another level, strategy selection can be handled by referencing materials, methods and settings to specific outcomes and preparing them in learning package form.

Existing collections of strategies (e.g., PLAN*, IPI, IS) take the form of a variety of reading, listening viewing and manipulating experiences that are referenced in learning guides and learning packages to stated outcomes.

Teacher Competencies

A complete system also provides for the development of teacher cmpetencies necessary to implement an outcome and competency based instructional program. Two such complete systems are Olson, et al. and PLAN*. Both training systems manifest all the characteristics of an outcome based instructional program. Flanagan and his colleagues (1975) describe the teacher development effort for PLAN*.

> It is believed essential that each new teacher be prepared for the new role required for the PLAN* educational system. To keep this as efficient as possible, a four-phase program was set up during the developmental phase of PLAN*. The first is an orientation phase in which the teacher visits PLAN* classes being conducted by experienced teachers and participates in a program of directed observation and orientation. The orientation phase is usually conducted in the spring of the year prior to teachers' participation in the PLAN* system. The observation period is followed by the second phase, an informal reading period extnding over the summer. The reading materials include discussions of the basic concepts and philosophy underlying PLAN* and individualized education in general. The third phase, usually conducted in late August, consists of a three- or four-day individualized program that uses modules, TLU's, objectives, and tests designed to acquaint the teacher with the basic information and skills essential for conducting a class in the PLAN* system. The last phase is an in-service training program. An appropriate supervisor observes the teacher at intervals during the early days of application of PLAN* and checks mastery on specific skills important to the effective functioninng of PLAN* in the classroom (pp. 147-8).

Since the program has goals of individualization and student participation in the decision process, the teacher's roles and responsibilities are somewhat different than those in a "regular" school setting. Teachers already in the PLAN* system have described their roles as "counselor", "tutor" and "facilitator."

Monitoring

The last major component of a totally integrated system is monitoring.

> After the first hour of work on a series of modules, there is a high probability that each student will be at a different point. Unless it is unilaterally decreed, all students will rarely be at the same point again as they proceed through their competency based programs (Hall and Jones, 1976, p. 113)

A monitoring system should facilitate the recording of diagnostic, placement, and achievement information. The information that is recorded in the system should serve at least two purposes; as a communication system for teachers, counselors, students, administrators, and parents, and also as a source to continually update and develop the educational program. The second purpose, that of educational program development is of paramount importance for a dynamic and functionally current system. In an effort to develop comprehensive recordkeeping systems that maximize the frequency, timelines and accuracy of performance reporting, some schools have adopted computerized approaches. Three such systems are the Westinghouse Learning Corporation's Project, PLAN*, Tracer, and the Seattle Public Schools Learning Management System (LMS).

Computerized systems are time consuming to develop and generally expensive to maintain. Few districts can afford to implement them in the short run. Though individual schools and districts have implemented each of the systems, state or intermediate agencies may find the cost saving implications of broad, areawide use of computer support systems worth exploring.

Because a comprehensive CBE Sourcebook will be available shortly, this paper will not attempt to delve too deeply into explanations of available systems. For illustrative purposes, the Oregon System will be introduced and explicated.

The Oregon Total Information System (OTIS) is an example of a computerized system designed to serve schools in Oregon on a nonprofit basis. OTIS provides a number of options for competency recordkeeping, including:

- Competency file. Each school or district may keep a file of their unique competencies with their unique numbering system.
- Assignment of competencies. Each school district may assign competency assessment and reporting to specific courses, departments and grade levels.
- Input of assessment data. A variety of input format options are provided that can be tailored to meet a school's needs.
- Computer printed reports. A variety of reports are available, including a district competency list, list of courses with competencies assessed, student status report, and student status on-line inquiry, and school analysis report.

Recordkeeping for Oregon Minimum Standards for Public Schools

As schools and districts in Oregon prepare to comply with the new minimum graduation requirements, they must develop new record keeping procedures. In reponse to this need, the Oregon Department of Education and personnel from 10 counties developed Oregon Graduation

Requirements — Guidelines for Recordkeeping Procedures and Sample Forms. This document describes the need for and responsibility of recordkeeping system planning team. The authors suggest a list of vital considerations which must be addressed.

- Required courses and electives. The planned courses in the areas of study requried of all students for graduation, as well as a wide range of elective courses, must be identified by the district.

- Minimum survival graduation competencies. The district must identify the minimum survival level competencies that will be required of all students for graduation... In general it is assumed that to increase the number of competencies will increase the complexity of the district recordkeeping system.

- Location of competencies within a school program. The teaching of a required minimum survival competency may be assigned to one course, to several courses, to a competency center or to a combination of these or other alternatives...

- Method of recording competency demonstration. If the teaching of minimum survival graduation competencies is assigned to planned courses, the district has at least two options: (a) a mark on a district checklist form could indicate the student's demonstration of competencies, while his passing grade would indicate the successful completion of overall course requirements; (b) the student's passing grade could indicate successful completion of the overall course requirements and the demonstration of specific competencies...

- Initial student competency status. The district must determine the starting point for keeping records on each student's demonstration of minimum survival competencies. If the student's demonstration of a competency is assigned to a particular grade level, it may be recorded at that time. The district may prefer to record the student's competency at the time it is demonstrated, even if it is at an earlier grade level...

- Level of detail recorded. Regarding the amount of detail that will be recorded for each student, a comprehensive district form could list all required goals, minimum graduation survival competencies, and performance indicators which will track the student's progress and will be maintained in the student's file. On the other hand, the issuance of a diplomas/and/or checkmark on the student's transcript may automatically indicate satisfactory completion of the required minimum performance requirements, as long as the competencies are described fully in district files and in classroom records...

- Resources for recordkeeping. The district should consider the resoures available for recordkeeping, including:
  - Data processing services available for the district's use.
  - Clerical personnel to be assigned for manual system.
  - Budget considerations.
  - Printing arrangements.
  - Plans for orientation of those involved...
- Numbering system and format. The rationale for a consistent numbering system to be used statewide is to facilitate the interpretation of records of students transferring between districts within the state...
- Procedures for updating competency requirements. The district-adopted competencies in effect at the time a student is initially enrolled should represent the contractual performance requirement for that student. Subsequent changes in the district competency list should not be retroactive...
- Special recordkeeping problems. The district's recordkeeping system should include provisions for students who present special recordkeeping problems. These may be students enrolled in open-entry/open-exit courses, students whose files contain errors, or students transferring (from or to) other districts...
- Data processing and/or manual systems. A data processing center can handle many recordkeeping tasks, such as printing out master competency lists, course lists, master schedules, and individual student scheduling. It can generate student status reports and student record information including student histories. It can process pre-ninth grade information on students so that a "beginning balance" can be developed for each student. On the other hand, any or all of these functions can be done manually (1974, pp. 5-9).

Potential Problems in Methodologies for Instructional Management

Costs

Competency based education does require increased recordkeeping for most schools and teachers. Though every effort should be made to design efficient and effective data management systems, it is likely that teachers will have to spend more time with data management tasks than in a non-competency based program.

Computer support systems, with potential to minimize teacher effort and reduce costs, are being developed. These systems are still relatively expensive, however, and thus available to only a few schools and districts.

Transferability of Current Systems

Commerically developed instructional management systems have traditionally been tied to a specific curriculum and set of instructional strategies. Recent developments, however, include the capability to incorporate locally developed goals, strategies and measurement items.

Most recently developed systems relate to individualized learning, and thus may not include all of the outcomes, strategies, measurement items, and monitoring features appropriate for life-related competency based programs.

Progress Reporting

As with many new developments, there is a period of transition during which old systems are maintained while new ones evolve. The practice of reporting student progress illustrates that sort of transition. Schools typically report through the traditional letter grade format (i.e., A, B, C, D, E or F). As they gain the technical capacity, many add reports on students' progress toward the stated outcomes. This progress reporting increases expense, and seems paradoxical to many parents and educators (i.e., because of the dichotomy between norm referenced grade reporting and criterion referenced progress reporting).

Robert Knott (1976) illustrates three recordkeeping and reporting approaches..."that have potential for overcoming the major administrative problems involved in non-grade/course based education (p. 16)."

- A typical approach is to link evaluation directly to learning experiences and use a pass/no-pass system to accumulate credits towards competencies. Other programs also link learning experiences to competencies but use an A-B-C/No Credit System where level of proficieny within a competency area are recognized (p. 16).

- More radical, but administratively difficult, recordkeeping systems use portfolios to document student demonstration and competencies. These portfolios are generally comprehensive, contain narrative evaluations of students and are more appropriate to small administrative units. This system does provide the student with excellent support documentation when applying for further schooling or employment (p.16).

- Most common, presently, is the practice of keeping dual record systems. A grade-course transcript with A-F grading is accompanied by a check-off list for competency demonstration. The problem area in this approach is the decision of whether or not to relate course evaluation to competency demonstration (p. 17).

Summary

This section addresses the alternative methods for CBE instructional management. A totally integrated instructional management system addresses needs relative to outcome identification, measurement of outcomes, strategies for program development based on the outcomes, and strategies for outcome based instruction. Each of these areas is explored to include discussions of management systems' outcome and competency components, instructional strategies components, test item components, teacher competencies development component and the total system monitoring component. Oregon's Recordkeeping Guidelines were presented for illustration.

CONCLUSION

There are perhaps three prime issues which either separately or together cause the diversification of methods and thus the system gaps made obvious by the preceeding review of the state-of-the-art of CBE.

The first issue is that there is no common agreement about what competency based education is. Two approaches, the descriptive and the prescriptive have been employed in attempts to arrive at definition clarity as to what CBE is. As yet neither approach has yielded a commonly accepted vision of what CBE is, perhaps because CBE has not been operative for a sufficient amount of time to yield sufficient supportive data for such a resolution.

The second issue arises from the difficulty of arriving at a coherent vision of what the desired competencies are. To date, most graduation oriented CBE programs address post-institutional capabilities as their outcome goals. The most common approach is to identify what it takes to be able to function well either in basic skills or in a broader range of life roles such as a life long learner, family member, consumer, etc. This task of developing coherent and relevant competencies is at best difficult for professional schools and programs and is perhaps virtually impossible for elementary, secondary and general higher education since it assumes empirical foundations or philosophical and value agreements which are nonexistant at present. Dealing with this issue adequately will require years of research and experimentation.

Finally, even if there were a commonly agreed upon definition of CBE and subsequent coherent sets of desirable and appropriate competencies, there would still be a deficit in the areas of demonstrably compatable teaching techniques, assessment procedures, and management practices.

While there are a great number of extant teaching models, assessment practices, and management systems, insufficient data has been generated to suggest that one approach is more beneficial than any other in supporting the development of particular competencies.

In conclusion then it seems that the rhetoric, policy, and theory of CBE, although immature itself, is well in advance of the practice of CBE. Thus far only in Oregon is there a consistent statewide effort to implement a comprehensive K-12 competency based system, and even there the first reports of broad based research into the practice and effects of CBE in Oregon will not be available until late in 1977. When similar policies in place or under development in such states as California, Michigan, New Jersey, New York, and Pennsylvania begin to have an effect on local school districts, there will be a broader state-of-the-art of CBE to be studied and reported. In the meanwhile this report on the state-of-the-art of K-12 CBE has had to rely upon such information as is currently available in the literature on CBE, in the existing reports on practice within the State of Oregon and in state and local systems elsewhere, and in descriptions of planning, instruction, measurement, and management subsystems which logically relate to CBE even if not originally developed to be part of a K-12 CBE system. Thus the state-of-the-art of competency based education methods, because of the CBE movements origins and relative immaturity, thus far has more theoretical and methodological gaps than it has substantive content.

SUMMARY

This paper explores the state-of-the-art of competency based education. Many of the examples of methods of CBE included in this paper are drawn from the CBE programs and support documents currently in use by the State of Oregon. After a discussion of the Purpose and Content of the paper the state-of-the-art of CBE is explored in four areas which span the entire gamut of the educational process. The four areas are planning, instruction, evaluation and management.

The Purpose and Content section includes a summary of nationwide trends in CBE and poses a working definition of competency based education. There is no nationally accepted, cohesive definition of competency based education at this time. Hence, many of the alternative methods described in the planning, instruction, evaluation, and recordkeeping sections are predicated on different operational definitions of CBE.

The planning section explores alternative approaches to and methods for the identification of educational competencies. The alternative methods are governed in part by variables which are presented in four categories:

- the nature of the governing authority
- the beliefs and/or rationale employed by individuals and groups that identify the outcomes
- the characteristics of the instructional program to which the outcomes apply
- the characteristics of the students who must achieve the outcomes

While these variables influence the identification of competency outcomes, they also influence the selection of instructional approaches, evaluation, and recordkeeping approaches. To the extent that the individuals who are responsible for the planning, instruction, evaluation and recordkeeping sequences of a CBE program are influenced by the above listed

variables alternative methods will be generated.

In the instruction section of the paper it is also pointed out that decisions regarding instructional strategies are influenced by the same variables which influence identification of competencies. Competency based education calls for instructional methods capable of fostering student progress toward and attainment of specified objectives. Such methods are examined in terms of seven roles a teacher needs to assume within a CBE program. Though these seven roles remain fairly constant, CBE methodologies may differ--and should differ in response to specific program objectives and students' identified needs. One instructional strategy--use of out-of-school activities--is illustrated through a specific example taken from a Seattle high school business curriculum.

The instruction section of the paper also includes descriptions of five alternative instructional models selected for discussion because of their apparent consistency with common characteristics of CBE. These five models--the OD Prime, the Kibler, et al., the Individually Prescribed Instruction, Program for Learning in Accordance with Needs, Individualized Science and Individually Guided Education--are discussed in terms of their salient characteristics and purposes. The illustration is designed to give the reader an idea of how basic CBE program components can take on different shapes as district or classroom needs warrant. Far from being a prescriptive set of unalterable directives, CBE program characteristics are subject to virtually limitless variation.

The evaluation section of the paper explores alternative methods for assessing outcomes and competencies. Four approaches to student assessment that are commonly used are described. First, the norm-referenced approach where student performance is interpreted by referencing the performance of others who have taken the test. Second, the criterion-referenced approach where performance on a task is measured against an absolute index without referencing the past performance of others on the same test. This approach is discussed as being the most appropriate for individual diagnostic/perscriptive decisions. Since personalization is one of the main concepts in some definitions of CBE (Schalock, Spady and Hathaway, 1976) perhaps the criterion-referenced approach is the most amenable to CBE. Third, the objectives referenced approach where performance on a test is interpreted by referencing the behavioral objective for which it was written. Fourth, the domain-referenced approach where performance on a task is interpreted by referencing a well-defined set of class of tasks (a domain). This approach allows inferences to be made via performance on the sample drawn from the domain to the domain as a whole.

Alternate methods of competency assessment may also be influenced by the same variables that would influence individuals who were identifying competencies and who were choosing or designing teaching techniques for CBE. The section includes a brief hypothetical description of the ways an assessment tool may be influenced by the tenets of the theoreticians discussed in the first section. The section concludes with a description of three sources for CBE compatable assessment material. The Clearinghouse for Applied Performance Testing is a program which defines the measurement of performance in an actual or simulated setting. The ERIC Clearinghouse on tests, measurement and evaluation is a collection of criterion-referenced tests. The Instructional Objectives Exchange provides educators with resource materials for making their instruction more effective.

The management section lists and explains the five general characteristics of a totally integrated instructional management system:

- an outcome-competencies component
- a collection of alternative learning strategies related to the

program's outcomes and competencies

- criterion-referenced test items
- provision for the development of teacher competencies necessary to successfully implement a full-scale CBE program
- a monitoring component
  (The Oregon Total Information System (OTIS) is cited as an example)

Four potential problems that may confront implementation of instructional management methodologies are explored briefly. First, CBE installation frequently demands extensive augmentation of current recordkeeping procedures. This can prove not only time consuming, but very expensive as well. Though computerized systems are becoming available on an increasingly widespread basis, they remain outside the financial reach of most districts.

Second, many systems lack transferability. Until very recently, most management systems were tied to a specific curriculum. This minimized their capability to incorporate locally developed goals and strategies—a crucial capability. Even now, many newly developed systems are related to individualized learning, and may not be fully adequate for the life-related elements of CBE program.

Third, methodologies for reporting student progress are in a period of transition. Traditional grading systems which are still in effect in most schools are not complementary with the sort of progress reporting approaches typically used in CBE program.

Fourth, while products and resources are available to assist districts in designing instructional management systems, there is currently no comprehensive, annotated index to such extant resources.

A CBE Sourcebook is currently under development by the Oregon Competency Based Education Program. The purpose of the CBE Sourcebook is to be two-fold: (1) to provide the user with a single source for the many resources that are useful in implementing and operating CBE; and (2) to provide the user with a complete description of each resource in the context of the functions it serves in operating a competency based education program. Resources described in the Sourcebook will be appropriate for individual or for group use. The resources will facilitate selecting or designing materials for a single activity or unit of instruction or for a comprehensive competency based education program. The resources will be carefully selected to insure their relevance and usefulness for persons designing and implementing competency based education programs consistent with the CBE processes mandated by the Oregon Board of Education.

The paper closes with a conclusion section which explores some of the "gaps" faced and exposed by a discussion of the state-of-the-art of CBE. Such "gaps" have implications for current practice as well as for research and development related to CBE.

APPENDIX A

GAGNE'S LEARNING HIERARCHY

GAGNE'S LEARNING HIERARCHY

Eight types of learning comprise Gagne's learning hierarchy. The types start at the most rudamentary level and progressively become more sophisticated and complex.

Type 1: Signal Learning. Based on Pavlov's respondent conditioning paradigm "The individual learns to make a general diffuse response to a signal." Educational example: learning to associate a spoken name of an object with the printed name of the object (signal stimulus) as a result of its (printed name) having been presented repeatedly with a picture of the object (unconditioned stimulus in this example if the student already knows the spoken name for the picture).

Type 2: Stimulus-Response Learning. Based on Thorndike's trial-and-error learning and on Skinner's operant conditioning paradigm "The learner acquires a precise response to a discriminated stimulus." Educational example: having the teacher provide praise and encouragement as a student of a foreign language becomes more and more proficient at correctly pronunciating the words in a lesson.

Type 3: Motor Chaining. Based on concepts of Guthrie and Skinner "A chain is a sequence of activities which consists of two or more stimulus-response units." Educational example: mastering the sequences involved in writing, swinging a golf club, operating a typewriter, or playing a piano.

Type 4: Verbal Association. Similar to Type 3, except that both the stimulus and the response elements are verbal. Internal mediating ideas may be more critical than in types 1 and 2. Educational Example: learning French equivalents of English words and longer associations such as learning a poem or speech.

Type 5: Discrimination Learning (among previously learned pairs) "The individual learns to make a different identifying responses to as many different stimuli, which may resemble each other in physical appearance to a greater or lesser degree." Educational example: learning in a Biology class the different characteristics which distinguish one animal species from another, or one class of plants from others.

Type 6: Concept Learning. "Making a common response to a class of stimuli that may differ from each other widely in physical appearance." Educational example: learning what is meant by such concepts as color, little, many, large, gravity, hexagon, etc.

Type 7: Rule Learning. Whereas Type 6 involved learning through exposure to concrete examples of the class, Type 7 is at a higher level of abstraction. In a sense, this can be depicted as learning rules, where a rule is defined as "an inferred capability that enables the individual to respond to a class of stimulus situations with a class of performances, the latter being predictably related to the former by a class of relations." Educational example: learning how to find the number of square feet in a rectangle, learning what procedures are necessary to determine whether a subject and predicate agree in number, etc.

Five instructional principles which facilitate rule learning:

- give the learner information about the nature of successful learning
- assist in identification of critical component concepts
- present verbal instructions and guidelines which facilitate forming chains of pertinant concepts
- present leading questions which encourage the learner to demonstrate the rule
- encourage the learner to give verbal descriptions of the rule

(Gagne, 1970, p.203)

Type 8: Problem Solving. Involves internal cognitive processes to a greater extent than is necessarily true of the previous seven types. Problem solving involves making use of the concepts and rules which have been learned and generating new concepts or rules so as to define a problem and find its solution(s). "Problem solving as a method of learning requires the learner to discover the higher-order rule without specific help." Educational example: finding how to do something that is not possible by merely following a simple rule. This might occur in social studies where students are to resolve differences between two hypothetical competing countries which have both manual interests and incompatable goals, or in mathematics courses where students are to find solutions to complicated algebra problems.

In using his instructional principles, Gagne identifies which effect the learner's responsiveness to instruction and his retention of what he learns:

- "Gaining and controlling attention..."
- "Informing the learner of expected outcomes..."
- "Stimulating the recall of relevant prerequisite capabilities..."
- "Presenting the stimuli inherent to the learning task..."
- "Offering guidance for learning..."
- "Providing feedback..."
- "Appraising performance..."
- "Making provisions for transferability..."
- "Insuring retention..."

(Gagne, 1970, p.304)

For Gagne, there are five major categories of human capabilities that are the outcomes of learning:

- verbal information
- intellectual skills
- cognitive strategies
- attitudes
- motor skills

(Gagne, 1974, p.64-68)

APPENDIX B

PIAGET'S STAGES OF COGNITIVE DEVELOPMENT AND POSITION ON TYPICAL PROBLEMS OF LEARNING

PIAGET'S STAGES OF COGNITIVE DEVELOPMENT AND POSITION ON TYPICAL PROBLEMS OF LEARNING

Stages of Cognitive Development

Birth to 2 years	Sensorimotor	Development of schemes primarily through sense and motor activities
2 to 7 years	Preoperational	Gradual acquisition of ability to conserve and decenter, but not capable of operations (reversibility)
7 to 11 years	Concrete operational	Capable of operations, but restricted to concrete experiences, not able to generalize to hypothetical experiences
11 to 14 years	Formal operational	Able to deal with abstractions, form hypotheses, consider possibilities

(Magoon and Garison, 1976, p.40)

Piaget's Position on Typical Problems of Learning

1. Capacity. In a theory such as Piaget's whereby development rests very largely on maturation, differences in potential are set at least in part by native differences. Development may be retarded by unfavorable environment, and advanced, at least to some extent, by more favorable environment.

2. Practice. The essence of practice is active discovery, and passive learning is ineffective, at least in early childhood. Repetitive practice may assist in the learning of some basic information (figurative), but it is not the way in which inventive transformations are learned (operative). The role of practice varies with developmental stage.

3. Motivation. Motivational conceptions are little emphasized, although there is considerable admiration for a position such as Dewey's that relates interest and effort. The theory of equilibrium suggests that the learner desires to reduce his internal conflicts, thus keeping his thoughts harmonious. In this, the motivation implications are similar to those of tension-reduction theories (homeostatis), or , in the cognitive sphere, of dissonance reduction.

4. Understanding. Understanding is the very aim of operative intelligence, and, as a logician, Piaget wants the learner to make rational inferences from givens. The notion of "structure" is basic, classifying Piaget's as a "centralist" theory.

5. Transfer. As a result of assimilation and accommodation, the growing child can comprehend an increasingly wide sphere of relationships. Although the concept of transfer of training is not focal, certainly problem-solving competence is, and this implies generalization of what is learned. One of the empirical problems is that of the concurrent emergence of a number of abilities when a new stage is reached.

6. Remembering and forgetting. Very often a test of the firmness of a new acquisition is provided by how well it is retained. Inhelder (1969) has devoted a chapter to the problem of memory in relation to intelligence, based on a larger study (Piaget, Inhelder, and Sinclair, 1968). This larger study is reminiscent of the work of Bartlett (1932), to whom acknowledgment is made. It was Bartlett's contention that memory is productive as well as reproductive, and this is brought out in relation to Piaget's concept of development. For example, children of 3 to 8 years were shown 10 sticks, 9 to 15 centimeters in length, arranged in serial order from the shortest to the longest. A week later, they were asked to draw what they had seen, and then to arrange the sticks as they remembered them to have been arranged. The same requests were repeated some months later. If the children were assigned to four operational stages, on first testing they yielded essentially correct responses (a series of sticks in ascending serial order by size.) Although these results are somewhat contaminated by having the seriation enter into the stage classification, other, more complex experiments led to the same conclusion. Memory is not simply a residue of the perception of what the child has seen; it is instead a symbolic representation of how the child has schematized what he saw.

   In some cases, in which causal relationship lies at the basis of what is perceived and remembered, memory improves over time, because the child's schemes become clearer to him. Of course, the outcome is not always improvement; an improper scheme can distort. In any case, memory cannot be treated as an ability separate from the functioning of cognitive processes as a whole.

(Hilgard et al. 1975, p. 343)

APPENDIX C

BRUNER'S INSTRUCTIONAL THEORY AND DISCOVERY LEARNING

BRUNER'S INSTRUCTIONAL THEORY
AND DISCOVERY LEARNING

To understand the concept of instruction as would Bruner, it is most important to recognize that he characterizes learning in the school as intellectual growth. Intellectual growth for Bruner is viewed as an increase in one's ability to integrate and to use new information. Bruner cautions educators to consider certain "benchmarks about the nature of intellectual growth against which to measure one's efforts at explanation" (Bruner, 1966, p.5):

1. Intellectual growth involves an ever-increasing independence from the direct eliciting influence of stimuli through the development of cognitive mediating processes which afford one the ability to deal with stimuli on a more symbolic level.
2. This growth involves development and refinement of one's internal objects and events representational system.
3. Growth also involves an ever-increasing ability to use words and symbols to logically analyze what we have done and can do in the future.
4. Intellectual growth is fostered by systematic and exploratory tutor-tutee relationships with various significant persons serving as tutor.
5. Language constitutes a tool and instrument which enables the learner to comprehend order in the environment as well as constitutes a means which facilitates learning.
6. With intellectual growth, one becomes capable of engaging in more than one transaction at any one time and is able to allocate intellectual resources wisely in coping with different environmental requirements.

Bruner has presented four themes which he acknowledges as reflecting his own views about education. The themes are evident in Bruner's theory of instruction.

Bruner's first theme notes the importance of how knowledge is organized or structured.

"The prevailing notion was that if you understood the structure of

> knowledge, that understanding would then permit you to go ahead on your own; you did not need to encounter everything in nature in order to know nature, but by understanding some deep principles you could extrapolate to the particulars as needed. Knowing with a canny strategy whereby you could know a great deal about a lot of things while keeping very little in mind." (Bruner, 1971, p.18)

The second theme concerns the readiness to learn. This theme deals with intellectual development and its implication for both curriculum and instruction. Bruner questioned popular notions that certain educational materials may be "too difficult" to be taught in early grades. He proposed that it may be possible to teach practically all subjects even to small children. One of his most quoted statements is: "We begin with the hypothesis that any subject can be taught effectively in some intellectually honest form to any child at any stage of development." (Bruner, 1960, p.33)

The third theme emphasizes the importance of intuition in the educational process. By intuition, Bruner means "The intellectual techniques of arriving at plausable but tentative formulations without going through the analytical steps by which such formulations could be found to be valid or invalid conclusions." (Bruner, 1960, p.13)

The fourth and final theme speaks to the issue of motivation of the desire to learn and the available means to instructors to stimulate such motiviation. In various papers, Bruner has contended that the educational experiences which stimulate motiviation are those in which the learner actively participates and personally experiences competence in dealing with his world.

In 1966, Bruner proposed four principles of discovery learning which comprise his former theory of instruction. These principles are:

- Predisposition to learn. This principle outlines conditions which predispose the student to be both willing and able to learn when he enters the classroom.

- Stucture and form of knowledge. This principle outlines the need for structural features. The body of material that is to be learned should be organized in some optional form so that the content can be managed and grasped by the learner.

- Sequencing of educational experiences. A theory of instruction, according to Bruner, should specify optimal sequences for presenting educational experiences. "Instruction consists of leading the learner through a sequence of statements and restatements of a problem or body of knowledge that increase the learners ability to grasp, transform and transfer what he is learning." (Bruner, 1966, p.49)

- Form and pacing of the reinforcement. "Learning depends upon knowledge of results and time when and at a place where the knowledge can be used for correction." (p.50) Bruner, while recognizing the rewards and punishments which are of central concern to behavior molifiers, prefers an informational rather than a drive reduction interpretation of reinforcement value in facilitating learning.

Bruner has presented four benefits which he believes are inherent in discovery learning approaches. These benefits include:

- Increase in intellectual potency. "The learner will be more likely to develop problem solving search patterns, to learn how to transform information and to organize it so that he can get the most out of that information, and to develop an expectancy that there usually is some orderliness in nature whether or not a "correct" answer is quickly forthcoming." (Snelbecker, 1974, p.425)

- Shift from extrinsic to intrinsic rewards. Bruner believes that when a student learns a concept or principle by discovering relationships among examples, in contrast with being given analytical statments about that concept or principal, the student gains greater satisfaction from the learning process and comes to realize that learning provides intrinsic rewards.

- Learning the heuristics or working strategies for making discoveries at some later time.

- An aid to retention and retrieval of information. Bruner has theorized that if new information is organized in a manner which decreases its complexity through a process of embeding it in the learners personal cognitive structure, retention and retrieval will be facilitated.

APPENDIX D

TABA'S LEVELS OF THINKING IN CONCEPT FORMATION

TABA'S LEVELS OF THINKING IN CONCEPT FORMATION

Taba with a strong interest in improving instruction in the social studies and language arts, identified levels or types of thinking involved in concept formation in the development of generalizations and inferences through the interpretation of raw data, and in the application of principles.

Concept Formation

> In its simplest form, concept development may be described as consisting of three processes or operations. One is the differentiation of the properties or characteristics of objects and events, such as differentiating the materials of which houses are built from other characteristics of houses. This differentiating involves analysis in the sense of breaking down global wholes into specific properties and elements.
>
> The second process is that of grouping. This process calls for abstracting certain common characteristics in an array of dissimilar objects or events and for grouping these on the basis of this similar property, such as grouping together hospitals, doctors, and medicine as something to do with health care or according to their availability as an index to the standard of living. Naturally, the same objects and events can be grouped in several different ways. For example, hospitals, X-rays, and surgical equipment can be grouped together as health facilities, as types of services, or as indices of standard of living, depending on the purpose of the grouping.
>
> The third process is that of categorizing and labeling. This process calls for the discovery of categories or labels which encompass and organize diverse objects and events, such as evolving the concept of a unit measurement from measuring with a cup, a yardstick, a plain stick, and a rubber band. It also involves the process of super- and subordination; that is, deciding which items can be subsumed under which category.
>
> In classrooms this cognitive task occurs in the form of enumerating or listing, such as identifying a series of specific items noted in a film or reported by a research committee, then grouping similar things, and finally, labeling the groups.

Interpretation of Data and Inference

> Essentially the cognitive task consists of evolving generalizations and principles from an analysis of concrete data. Several subprocesses are involved. The first and the simplest is that of identifying specific points in the data. This process is somewhat analogous to the listing or enumeration proceding grouping. The second process is that of explaining specific items or events, such as why ocean currents affect temperature, why Mexico employes the "each one teach

one" system in eradicating illiteracy, or why the way of life in California changed when its harbors were opened for free trade. This process also involves relating the points of information to each other to enlarge their meaning and to establish relationships.

The third operation is that of forming inferences which go beyond that which is directly given, such as inferring, from the comparison of the data on population composition with data on standards of living in certain Lating American states, that countries with predominantly white populations tend to have a higher standard of living.

Interpretation of data and formulation of inferences takes place in the classroom whenever the students must cope with raw data of one sort or another, such as comparing the imports and exports of several countries or analyzing and systhesizing the factors which determine the level of technological development in a given culture by examining the tools and techniques used in the production of goods.

Application of Principles

A third cognitive task is that of applying known principles and facts to explain new phenomena or to predict consequences from known conditions. For example, if one knows what a desert is like, what way of life it permits, and how water affects the productivity of the soil, one can predict what might happen to the desert way of life if water became available.

This cognitive task requires essentially two different operations. One is that of predicting and hypothesizing. This process requires an analysis of the problem and of the conditions in order to determine which facts and principles are relevant and which are not. Second is that of developing informational or logical parameters which constitute the casual links between the conditions and the prediction and, in fact, make a rational prediction or explanation possible. For example, if one predicts that the presence of water in the desert will cause cities to be built, one needs also to make explicit the chain of causal links that leads from the availability of water to the building of cities. These chains may consist of logical conditions, such as that the presence of water is the only condition to make the soil productive, or from factual conditions, such as whether the desert soil contains salt or not. (Taba, 1965, p.536-537)

APPENDIX E

GUIDELINES AND PRINCIPLES OF TRANSFER

GUIDELINES AND PRINCIPLES OF TRANSFER

Transfer of learning occurs when a person's learning in one situation influences his learning and performance in other situations. If there were no transfer at all, students would need to be taught specifically every act that they ever were to perform in any situation. In its broadest sense, transfer of learning is basic to the whole notion of schooling. Some guidelines for teaching to transfer include:

- maximize the similarity between teaching and the ultimate testing situation
- provide adequate experience with the original task
- provide for variety of examples when teaching concepts and principles
- label or identify important features of a task
- insure that general principles are understood before requiring transfer

(Ellis, 1965, p. 70-71)

Some Principles of transfer:

- Over-all task similarity. Transfer of training is greatest when the training conditions are highly similar to those of the ultimate testing conditions.
- Stimulus similarity. When a task requires the learner to make the same response to new but similar stimuli, positive transfer increases with increasing stimulus similarity.
- Response similarity. When a task requires the learner to make a new or different response to the same stimuli, transfer tends to be negative and increases as the responses become less similar.
    a. Under conditions of high response similarity, this condition can produce positive transfer.
    b. Also, it is usually more difficult under this condition to obtain negative transfer in verbal learning than it is in motor skills training.
- Joint stimulus-response variation. If the responses in the transfer task are different from those in the original task, then the greater the similarity of stimuli, the less the positive transfer.

- Learning-to-learn. Cumulative practice in learning a series of related tasks or problems leads to increased facility in learning how to learn.

- Early-task learning. Transfer is maximized if greater effort is spent in mastering the early of a series of related tasks.

- Insight. Insight, defined behaviorally as the rapid solution of problems, appears to develop as a result of extensive practice in solving similar or related classes of problems.

- Warm-up. Warm-up is the pronounced but temporary facilitating effect resulting from practice in some activity prior to learning the transfer task.

- Time interval between tasks. Performance on the second task is minimally determined by the time elapsing between original and transfer tasks, as long as the transfer task involves little memory for specific aspects of the original task.

- Mediated transfer. Transfer can occur as a result of mediation due to the network of associative linkages between tasks.

- Bilateral transfer. Positive transfer can be obtained as a result of practice with one limb to its analogous limb.

- Task or stimulus variety. In general, variety of tasks, or of their stimulus components, during original learning increases the amount of positive transfer obtained.

- Amount of practice on the original task. The greater the amount of practice on the original task, the greater the likelyhood of positive transfer; negative transfer is likely to occur following only limited practice on the original task.

- Task characteristics. No clear-cut generalizations about the role of task characteristics such as difficulty or complexity appear evident.

- Stimulus predifferentiation. Relevant S pretraining leads to positive transfer when the transfer task involves learning; evidence for relevant S effects on perceptual tasks is negative or at best dubious.

- Understanding and transfer. Transfer is greater if the learner understands the general rules or principles which are appropriate in solving new problems.

- Group learning. There is no evidence for the automatic transfer of problem solving skills from a group to an individual situation.

(Ellis, 1965, p.71-73).

APPENDIX F

SAMPLE OF COMPETENCY STATEMENTS CLASSIFIED BY THEIR FUNCTION

SAMPLE OF COMPETENCY STATEMENTS CLASSIFIED BY THEIR FUNCTION

COMPETENCY	CLASSIFICATION
Personal Development	
Communication	
(Read)	
"The student will be able to comprehend reading matter."	Reading Abstract - in school Cognitive
"The student will read a novel and be able to explain the plot."	Reading Abstract - in school Cognitive
(Write)	
"The student will be able to write legibly."	Writing Abstract - in school Cognitive
"The student will write a report on a selected topic."	Writing Abstract - in school Cognitive
(Listen)	
"The student will be able to attent to an oral presentation."	Abstract - in school Stimulus
"The student will show courtesy by listening attentively to an oral presentation."	Abstract - in school Stimulus
(Speak)	
"The student will present his/her point of view on a topic, orally."	Abstract - in school Cognitive
"The student will be able to give an oral presentation in class."	Abstract - in school Cognitive
(Analyze)	
"The student will analyze."	Unobservable
"The student will listen to an oral presentation and be able to analyze the pros and cons of the presentation."	Abstract - in school Cognitive

COMPETENCY	CLASSIFICATION
(Compute)	
"The student will be able to perform multiplication on 3 digit numbers."	Abstract - in school Computation Cognitive
"The student will be able to understand the meaning of a fraction."	Abstract - in school Computation Cognitive
(Science)	
"The student can solve problems using scientific and technological processes."	Applied - in school Cognitive
"The student will understand basic physics principles."	Abstract - in school Cognitive
(Health mind and body)	
"The student will know how to deal with personal stress."	Abstract - out of school Cognitive
"The student will demonstrate physical skills and abilities which will contribute to enjoyment of a variety of sports as a leisure lifetime activity."	Applied - out of school Psychomotor
"The student will have the ability to develop skills and knowledges that will prepare them to enjoy a variety of sports as a leisure lifetime activity."	Applied - out of school Cognitive
Social Responsibility	
(Citizen in the community, state, and nation)	
"The student know how to vote in community, state, and national elections."	Abstract - out of school Cognitive
"The student will be able to analyze candidates platforms in order to vote intelligently in an election."	Abstract - out of school Cognitive
(Citizen on streets and highways)	
"The student will function effectively as an operator of a motor vehicle."	Applied - out of school Cognitive

COMPETENCY	CLASSIFICATION
"The student will understand the laws of the highway."	Abstract - out of school Cognitive
(Citizen with environment)	
"The student will be able to analyze the costs and benefits of alternative solutions to environmental problems."	Applied - out of school Cognitive Relevant for a career in stated discip.
"The student will understand the effects of pollution."	Abstract - out of school Cognitive
(Consumer of goods and services)	
"The student will function as a consumer in the market place."	Applied - out of school Cognitive
"The student will understand the rights of the buyer and seller."	Abstract - out of school Cognitive

Career Development

(Career development)	
"The student will demonstrate the ability to make a job application."	Applied - out of school Cognitive
"The student will maintain a positive attitude in a working atmosphere."	Applied - out of school Affective

APPENDIX G

TAXONOMY OF EDUCATIONAL OBJECTIVES:

COGNITIVE DOMAIN

AFFECTIVE DOMAIN

PSYCHOMOTOR DOMAIN

TAXONOMY OF EDUCATIONAL OBJECTIVES: COGNITIVE DOMAIN

The authors (Bloom, Engelhart, Forst, Hill & Krathwohl, 1956) of this taxonomy identified six major areas within which cognitive objectives may be classified. These areas are defined as:

Taxonomy Classification	KEY WORDS Examples of Infinitives	 Examples of Direct Objects
1.00 Knowledge		
1.10 Knowledge of Specifics		
1.11 Knowledge of Terminology	to define, to distinguish, to acquire, to identify, to recall, to recognize	vocabulary, terms, terminology, meaning(s), definitions, referents, elements
1.12 Knowledge of Specific Facts	to recall, to recognize, to acquire, to identify	facts, factual information, (sources), (names), (dates), (events), (persons), (places), (time periods), properties, examples, phenomena
1.20 Knowledge of Ways and Means of Dealing with Specifics		
1.21 Knowledge of Conventions	to recall, to identify, to recognize, to acquire	form(s), conventions, uses, usage, rules, ways, devices, symbols, representations, style(s), format(s)
1.22 Knowledge of Trends, Sequences	to recall, to recognize, to acquire, to identify	action(s), processes, movement(s) continuity, development(s), trend(s), sequence(s), causes, relationship(s), forces, influences

1.23	Knowledge of Classifications and Categories	to recall, to recognize, to acquire, to identify	area(s), type(s), feature(s), class(es), set(s), division(s), arrangement(s), classification(s), category/categories
1.24	Knowledge of Criteria	to recall, to recognize, to acquire, to identify	criteria, basics, elements
1.25	Knowledge of Methodology	to recall, to recognize, to acquire, to identify	methods, techniques, approaches, uses, procedures, treatments
1.30	Knowledge of the Universals and Abstractions in a Field		
1.31	Knowledge of Principles, Generalizations	to recall, to recognize, to acquire, to identify	principle(s), generalization(s), proposition(s), fundamentals, laws, principal elements, implication(s)
1.32	Knowledge of Theories and Structures	to recall, to recognize, to acquire, to identify	theories, bases, interrelations, structure(s), organization(s), formulation(s)
2.00	Comprehension		
2.10	Translation	to translate, to transform, to give in own words, to illustrate, to prepare, to read, to represent, to change, to rephrase, to restate	meaning(s), sample(s), definitions, abstractions, representations, words, phrases
2.20	Interpretations	to interpret, to reorder, to rearrange, to differentiate, to distinguish, to make, to draw, to explain, to demonstrate	relevancies, relationships, essentials, aspects, new view(s), qualifications, conclusions, methods, theories, abstractions

TAXONOMY OF EDUCATIONAL OBJECTIVES: COGNITIVE DOMAIN

2.30 Extrapolation	to estimate, to infer, to conclued, to predict, to differentiate, to determine, to extend, to interpolate, to extrapolate, to fill in, to draw	consequences, implications, conclusions, factors, ramifications, meanings, corollaries, effects, probabilities
3.00 Application	to apply, to generalize, to relate, to choose, to develop, to organize, to use, to employ, to transfer, to restructure, to classify	principles, laws, conclusions, effects, methods, theories, abstractions, situations, generalizations, processes, phenomena, procedures
4.00 Analysis		
4.10 Analysis of Elements	to distinguish, to detect, to identify, to classify, to discriminate, to recognize, to categorize, to deduce	elements, hypothesis/hypotheses, conclusions, assumptions, statements (of fact), statements (of intent), arguments, particulars
4.20 Analysis of Relationships	to analyze, to contrast, to compare, to distinguish, to deduce	relationships, interrelations, relevance, relevancies, themes, evidence, fallacies, arguments, cause-effect(s), consistency/consistencies, parts, ideas, assumtions
4.30 Analysis of Organizational Principles	to analyze, to distinguish, to detect, to deduce	form(s), pattern(s), purpose(s), point(s) of view(s), techniques, bias(es), structure(s), theme(s), arrangement(s), organization(s)
5.00 Synthesis		
5.10 Production of a Unique communication	to write, to tell, to relate, to produce, to constitute, to transmit, to originate, to modify, to document	structure(s), pattern(s), product(s), performance(s), design(s), work(s), communications, effort(s), specifics, composition(s)

TAXONOMY OF EDUCATIONAL OBJECTIVES: COGNITIVE DOMAIN

5.20	Production of a Plan, or Proposed Set of Operations	to propose, to plan, to produce, to design, to modify, to specify	plan(s) objectives, specification(s), schematic(s), operations, way(s), solution(s), means
5.30	Derivation of a Set of Abstract Relations	to produce, to derive, to develop, to combine, to organize, to synthesize, to classify, to deduce, to develop, to formulate, to modify	phenomena, taxonomies, concept(s), scheme(s), theories, relationships, abstractions, generalizations, hypotheses, perceptions, ways, discoveries
6.00	Evaluation		
6.10	Judgments in Terms of Internal Evidence	to judge, to argue, to validate, to assess, to decide	accuracy/accuracies, consistency/consistencies, fallacies, reliability, flaws, errors, precision, exactness
6.20	Judgments in Terms of External Criteria	to judge, to argue, to consider, to compare, to contrast, to standardize, to appraise	ends, means, efficiency, economy/economics, utility, alternatives, courses of action, standards, theories, generalizations

Source: Metfessel, Michael, and Kirsner (1969, pp. 228-229)

TAXONOMY OF EDUCATIONAL OBJECTIVES: AFFECTIVE DOMAIN

The dimension underlying the taxonomy in the affective domain is one of inner growth and takes place as a person becomes aware of and then adopts the attitudes, principles, codes and sanctions that support his value judgments and guide his conduct (Krathwohl, Bloom & Masia, 1964, p. 30).

	KEY WORDS	
Taxonomy Classification	Examples of Infinitives	Examples of Direct Objects
1.0 Receiving		
1.1 Awareness	to differentiate, to separate, to set apart, to share	sights, sounds, events, designs, arrangements
1.2 Willingness to Receive	to accumulate, to select, to combine, to accept	models, examples, shapes, sizes, meters, cadences
1.3 Controlled or Selected Attention	to select, to posturally respond to, to listen (for), to control	alternatives, answers, rhythms, nuances
2.0 Responding		
2.1 Acquiescence in Responding	to comply (with), to follow, to commend, to approve	directions, instructions, laws, policies, demonstrations
2.2 Willingness to Respond	to volunteer, to discuss, to practice, to play	instruments, games, dramatic works, charades, burlesques
2.3 Satisfaction in Response	to applaud, to acclaim, to spend leisure time in, to augment	speeches, plays, presentations, writings
3.0 Valuing		
3.1 Acceptance of a Value	to increase measured proficiency in, to increase numbers of, to relinquish, to specify	group membership(s), artistic productions, musical productions, personal friendships

TAXONOMY OF EDUCATIONAL OBJECTIVES: AFFECTIVE DOMAIN

3.2 Preference for a Value	to assist, to subsidize, to help, to support	artists, projects, viewpoints, arguments
3.3 Commitment	to deny, to protest, to debate, to argue	deceptions, irrelevancies, abdications, irrationalities
4.0 Organization		
4.1 Conceptualization of a Value	to discuss, to theorize (on), to abstract, to compare	parameters, codes, standards, goals
4.2 Organization of a Value System	to balance, to organize, to define, to formulate	systems, approaches, criteria, limits
5.0 Characterization by Value or Value Complex		
5.1 Generalized Set	to revise, to change, to complete, to require	plans, behavior, methods, effort(s)
5.2 Characterization	to be rated high by peers in, to be rated high by superiors in, to be rated high by subordinates in and to avoid, to manage, to resolve, to resist	humanitarianism, ethics, integrity, maturity extravagance(s), excesses, conflicts, exorbitancy/exorbitancies

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Source: Metfessel, Michael, and Kirsner (1969, pp. 230-231).

TAXONOMY OF EDUCATIONAL OBJECTIVES: PSYCHOMOTOR DOMAIN

Kibler, Barker and Miles (1970) offered a classification based on the sequence of events in a child's development: Motor behavior develops from gross to fine movements, and motor acts in communicative behavior develop from nonverbal to verbal activities. The categories, definitions and examples of objectives in the psychomotor domain are presented below.

Taxonomic Classification	Examples
1.00 Gross Body Movements: Although requiring some coordination with the eye or ear, objectives in this category usually emphasize strength, speed or precision in gross movement.	
1.10 Movements Involving Upper Limbs	to be able to throw a baseball 36 feet
1.20 Movements Involving Lower Limbs	to be able to run the 100-yard dash in 15 seconds
1.30 Movements Involving Two or More Body Units	to be able to swim 100 yards using the Australian crawl
2.00 Finely Coordinated Movements: Patterns or sequence of coordinated movements, usually involving eye or ear and body, and usually requiring some practice to obtain proficiency.	
2.10 Hand-Finger Movement	to translate a paragraph from Braille with 100 percent accuracy
2.20 Hand-Eye Coordination	to be able to type an average of 45 words per minute for 5 minutes with fewer than six errors
2.30 Hand-Ear Coordination	to be able to tune a guitar to a note played on the piano

TAXONOMY OF EDUCATIONAL OBJECTIVES: PSYCHOMOTOR DOMAIN

2.40	Hand-Eye-Foot Coordination	to be able swiftly and safely to complete four prescribed objects on a lathe within particular tolerances
2.50	Combinations of Coordinated Movements	to be able to drive a car along a main street for three blocks without violating any traffic laws
3.00	Nonverbal Communication Sets: Learned behaviors that attempt to communicate a message to a receiver without the use of words.	
3.10	Facial Expressions	to be able to show "interest" in another
3.20	Gestures	to be able to communicate with a deaf person by means of sign language
3.30	Bodily Movements	to be able to portray, in mime, a glutton at dinner
4.00	Speech Behaviors: Objectives related to speech production. Usually these objectives are found in communications, drama, speech, and speech correction curricula.	
4.10	Sound Production	to be able to produce the vowel sounds
4.20	Sound-Word Formation	to be able to recite a poem in French without mispronunciation
4.30	Sound Projection	to be able to speak with 90 percent comprehensibility to a listener placed five feet away in a 20-decibel noise field
4.40	Sound-Gesture Coordination	given a 3-minute verbal message, the student can, through gesture and movement, transmit the message with no loss of comprehension in 1.5 minutes or less

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Source: Adapted from Kibler, Barker, and Miles (1970).

APPENDIX H

CHARACTERISTIC SIMILARITIES AND DIFFERENCES BETWEEN NORM-REFERENCED AND CRITERION-REFERENCED ACHIEVEMENT TESTS

CHARACTERISTIC SIMILARITIES AND DIFFERENCES BETWEEN NORM-REFERENCED AND CRITERION-REFERENCED ACHIEVEMENT TESTS

Norm-Referenced Tests	Criterion-Referenced Tests
Content Specifications	
1. Topics outlined and weighted according to importance; number of items per topic is directly proportional to importance.	1. Topics broken down into specific educational objectives; number of items per objective is usually constant. In any case, all objectives are equally represented since each has its own score.
2. Both omission of important content and inclusion of unimportant content are serious flaws that distort meaning of scores.	2. Omission of important tasks reduces overall value of instrument but does not affect meaning of scores. Unimportant objectives can be ignored.
3. Test usually covers broadly defined educational goals that represent the most widely adopted school curricula.	3. Test covers a set of specific educational objectives.
4. Altering a test to fit a specific local curriculum is very difficult; it is usually easier to build such a test from scratch.	4. The set of objectives used may be easily selected or modified to fit local curricula.
Item Writing Specifications	
1. Items are usually written to learning objectives which represent a sample of those relevant to the goals being measured. Each goal is systematically sampled but objectives are not.	1. Items are written to learning objectives; each objective is systematically sampled.
2. Single items often require knowledge of several aspects of the content.	2. Items refer only to the objective to which they are written.
Desirable Item Characteristics	
The best items are those that:	The best items are those that:
1. discriminate well between those who score high and those who score low on the test,	1. discriminate between those who have and have not had effective instruction to that objective,
2. Show growth from grade to grade,	2. show mastery immediately after the objective has been achieved,
3. are about midrange in difficulty (but some items at each extreme are also desirable).	3. have preinstruction difficulties approaching 0 (almost all get them right).

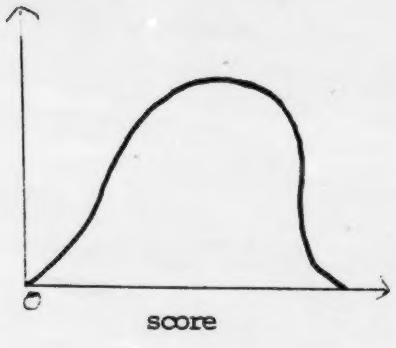
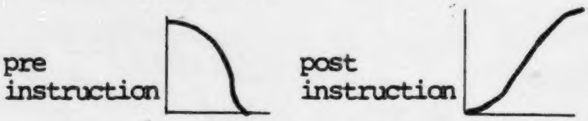
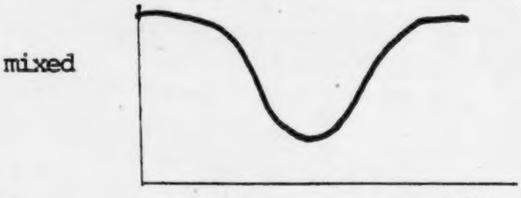
Administration

1. Standardized conditions of administration are essential including control of time (sometimes tests are speeded but not always).	1. More latitude in conditions is permissible. Control of time is rarely appropriate (unless speed is part of task).
2. Parts cannot be omitted without damage to meaning of total.	2. Parts can be omitted at will since there is no total score.

Scores

1. Raw scores rarely have much direct meaning.	1. Raw scores have some direct meaning about achievement of the objective being measured.
2. Measurement places person on hypothetical scale of amount of trait.	2. Measurement refers to scales based on visible performance.
3. Scale usually established by norms (comparative performances).	3. Scale is usually established by judgement and convention concerning adequate and inadequate performance but norms may exist and help.
4. Derived scores are used such as standard scores, percentile ranks, grade equivalent scores.	4. Scores used are number right, and categories such as mastery and nonmastery.
5. Score reports usually imply value, i.e., performance was good or poor.	5. Score reports are less well adapted to making conclusions about the quality of student or program performance.
6. All items contribute to part and total scores.	6. Each objective has its own score; meaningful total scores are usually not possible.

Score Distributions

1. Score distributions that are approximately normal are desirable, e.g., 	1. Score distributions that are skewed are desirable, e.g., 
	2. If the group tested includes both preinstructed and instructed students, distribution should be U-shaped, e.g., 

Reliability

1. Test-retest coefficients should be high for each score.	1. Test-retest coefficients should be high for each objective in a mixed sample (as above).
2. Internal consistency coefficients should be substantial for each score.	2. Internal consistency coefficients should be high for each objective in a mixed sample.

Content Validity

1. Content coverage and emphasis should be judged adequate.	1. Adequacy of coverage of behavior specified by objective should be adequate.
2. Fit of items to their intended content category is a matter of judgment.	2. Fit of items to their intended content category is a matter of judgment.

Construct Validity

1. Scores show growth during years of school attendance.	1. Scores for objectives exhibit sensitivity to instruction, i.e., change from wrong to right after effective instruction.
2. Scores show greatest growth during years of relevant instruction.	2. Items for one objective are more closely related than across objectives.
3. Groups with more training average better than groups with less.	3. General background plays less role than in norm-referenced tests (this implies less cultural bias).
4. High scoring students can more often solve problems requiring the knowledge than low scoring students.	4. High scoring students can more often solve problems requiring the knowledge than low scoring students.
5. Relationships among items should correspond (show patterns) to relationships among content categories (e.g., results of factor analyses should be logical.	5. Relationships among items should correspond (show patterns) to relationships among content categories (e.g., results of factor analyses should be logical).
	6. Where a learning hierarchy is known to exist performance on higher objectives will predict performance on lower order objectives, and demonstrated mastery of lower order objectives facilitates learning of higher order objectives (e.g., positive vertical transfer).

Criterion Related Validity

1. Scores correlate well with other measures of achievement such as teachers' marks and other tests.	1. Scores correlate well with other measures of the objective.
2. Scores predict performance in class or on tasks dependent on capabilities being measured.	

Uses

1. Assessment of status of school system (or classes or students) with respect to achievement in basic skills and content area.	1. Assessment of status of students (or classes or school system) with respect to curriculum objectives.
2. Program evaluation for outcomes of long term growth (at least 6 months) towards major goals.	2. Program evaluation for long or short term attainment of specific objectives.
3. Selection and placement of students in courses and programs on the basis of level of basic skills or general knowledge of content.	3. Diagnosis of instructional needs of individual students and groups of students.
4. Information for curriculum planning.	4. Information for planning of classroom instruction.
5. Monitoring yearly progress of schools and school systems with respect to goals.	5. Monitoring progress of students with respect to instructional objectives.

APPENDIX I

SAMPLE OF CRITERION REFERENCED TESTS AVAILABLE FROM ERIC CLEARINGHOUSE ON TEST, MEASUREMENT AND EVALUATION, E.T.S., PRINCETON, NEW JERSEY

SAMPLE OF CRITERION REFERENCED TESTS AVAILABLE FROM ERIC CLEARINGHOUSE ON TEST, MEASUREMENT, AND EVALUATION, E.T.S., PRINCETON, NEW JERSEY

The APELL Test by Elenore V. Cochran and James L. Shannon, 1969, EDCODYNE Corporation.

Description: A system of instructional diagnosis and design which assists the teacher in assessing the child's school entry-level development, the test diagnoses skill levels based on specific performance objectives covering: Pre-Reading (visual discrimination, auditory discrimination, letter names); Pre-Math (attributes, number concepts, number facts); and Language (nouns, pronouns, verbs, adjectives, plurals, prepositions). The manual gives a rationale for each objective and suggests related instructional activities. A Spanish translation of the test is available. The 50-item pictorial instrument is designed for children 4-1/2 to 7, but it may be useful for somewhat younger or older children. A supplement to the manual expresses the hope that the test be used "to support the empirical notion of performance rather than the usual norm comparisons associated with standardized tests."

Basic Concept Inventory Field research edition by Siegfried Engelman, 1967, Follett Educational Corporation.

Description: The author intends the inventory to be used primarily for culturally disadvantaged preschool and kindergarten children, slow learners, emotionally disturbed children, and mentally retarded children. It is a broad checklist of basic concepts that are involved in new learning situations. The inventory may be used for diagnostic purposes or for group placement. Subjectively selected subtests are: Basic Concepts; Statement Repetition and Comprehension; and Pattern Awareness. The test is described as a criterion-referenced test in that it was designed "to evaluate the instruction the child has received on specific, relevant skills."

Experiences with Sets and Numbers: Mathematics Evaluation Materials Package Project by Howard Russell, 1972, The Ontario Institute for Studies in Education, 252 Bloor Street West, Toronto 5, Ontario, Canada.

Description: The Mathematics Evaluation Materials Package (MEMP) is a set of performance objectives and companion test items for mathematics education in grades 4 to 6. "Experiences with Sets and Numbers" includes items on: place values, Roman numerals; ordering of whole numbers; >, <, and =; special subsets of the whole numbers; intersection and union of sets; rounding numbers; and positive and negative numbers in concrete situations.

Explorations in Biology by Eugenia M. Koos and James Y. Chan, 1972, Mid-Continent Regional Educational Laboratory.

Description: This is a series of eight parallel, singletopic tests designed to measure the attainment of 14 objectives concerned with inquiry skills in biology. The single-topic, simulation format was selected to accommodate the unitary nature of an inquiry. Objectives selected for the tests were based on studies by various science educators and curriculum specialists. These objectives were also in agreement with the goals and outcomes of the BSCS biology curriculum. The series is intended for the average sophomore student in the first course in high school biology. Some of the target group taking the tests as a pretest in the fall may demonstrate attainment of a particular criterion level. There would then be no need for the particular students to take instruction intended to guide the target group toward this level. The items were written by educators and test construction specialists familiar with tenth grade Biology curriculum and with inquiry processes.

FLES Criterion-Referenced Tests by Robert M. Offenberg, David Montalvo, and Edward K. Brown, 1971, Office of Research and Evaluation, School District of Philadelphia.

Description: Three criterion referenced tests were developed to evaluate the Latin FLES program in the School District of Philadelphia. The testing involved 4,000 fourth, fifth, and sixth-grade pupils receiving 15 to 20 minutes Latin instruction daily from Latin teachers who served several schools. The primary objectives of the program were: (1) to introduce children to basic Latin structure and vocabulary; (2) to extend the English vocabulary of children through the study of Latin roots and affixes; and (3) to acquaint children with classical culture and its influence on the present. Achievement was measured by means of a criterion-referenced test battery containing a Latin Culture Test, a Word Power Game, and an Oral Latin Test. The Latin Culture Test consists of two parts. Items on the test are taken from the fifty-grade course of study and constitute a sample of major facts and concepts which the pupils should have acquired if they succeeded in mastering the culture curriculum for the first year of study. The test was designed so that students with adequate mastery should score at least 75 percent and students doing minimally passing work should score about 60 percent. The Wrod Power Game was designed to assess student mastery of English skills. It is divided into three parts, the first of which contains nine items which check the student's knowledge of English derivatives and cognates actually appearing in the Program. Items in the next part are based on English vocabulary not taught in the program but derivable from Latin roots and affixes. The third section contains five items which are based on the material included in the program but which differ from the first two parts (administered orally) in that the pupil is required to read the item. The Oral Latin Test contains material taken directly from the course of study or the visual aids (flash cards and so forth) designed for use with it.

Illinois Tests in the Teaching of English by William H. Evans and Paul H. Jacobs, 1969, 1972, Southern Illinois University Press.

Description: This is a battery of four tests designed to measure the achievement of preservice and inservice high school English teachers on the basis of certain objectives established by specialists in education and by practicing teachers. The authors describe the tests as criterion-referenced in that their prupose if "to measure the individual teachers' achievement of certain objectives based on criteria established by his/her colleagues." Knowledge of Language: Competency Test A covers (1) the functioning of language; (2) the principles of semantics; (3) systems of English grammer; (4) the history of the English language, including its phonological, morphological, and systactic changes; and (5) concepts about levels of usage and dialictology (84 items). Attitude and Knowledge in Written Composition: Competency Test B is concerned with teachers' attitudes toward or philosophy of the teaching of written composition. It also assesses their ability to recognize characteristics of good writing, perceive the complexities of composing, and recognize and analyze the strengths and weaknesses of a term and the identification of their relative level of difficulty provide the examiner with a criterion-referenced scale."

Ohio Vocational Interest Survey (OVIS) by Ayres G. D'Costa, David W. Winefordner, John G. Odgers, and Paul B. Koons, Jr., 1969, Harcourt Brace Jovanovich, Inc.

Description: This survey is designed to help students in grades 8 to 12 with educational and vocational planning. Scores rank students' vocational interests along 24 scales derived from the Dictionary of Occupational Titles (DOT), a classification of 21,741 jobs in terms of involvement with people, data, and things.

Oral Reading Criterion Test for Determining Independent and Instructional Reading Levels by Edward Fry, 1971, Dreier Educational Systems, Inc.

Description: The test was devised to determine the independent and instructional reading levels of both children and adults. Simple first-grade primer material is the lowest level on the test. The highest level, the seventh-grade reading level, is representative of popular adult and nontechnical secondary reading levels. A chart on the last page of the test enables the examiner to determine the difficulty level of instructional materials that the teacher plans to use.

Phonics Criterion Test of 99 Phoneme Grapheme Correspondences by Edward Fry, 1971, Dreier Educational Systems, Inc.

Description: This test uses nonsense syllables to determine the areas of difficulty in phonics. The test covers: easy consonants, consonant digraphs, consonant second sounds, schwa sounds, long vowel D digraphs, vowel plus r, broad o, diphthongs, difficulty vowels, consonant blends, and consonant exceptions.

Format and Administration: The test is individually administered to children in grades 1-3. There are 99 items. No time estimate for administration is given.

Response Mode and Scoring: The children are asked to decide how nonsense syllables are pronounced, and the test is scored by the examiner.

Technical Information: No technical information is given.

Prescriptive Mathematics Inventory by John Gessel, 1972, CTB/McGraw-Hill.

Description: This test assesses mastery of objectives composition and communicate this analysis effectively (62 items).

The Instant Word Recognition Test by Edward Fry, 1971, Educational Systems, Inc.

Description: This test measures sight recognition of the Instant Words in order to determine the starting point in teaching Instant Words, a graded high-frequency reading vocabulary. It may also be used to determine general reading achievement for group placement. It is available in two equivalent forms for each of two levels.

Format and Administration: The test is intended for grades 1 through 4. It may also be administered to older children in remedial reading programs. It can be administered individually or to small groups by a teacher without instruction. The examiner reads 48 lines of words and sentences containing the keyed word. The answer sheet contains five words for each sentence, one of which is the word the examiner has read. No time estimate is given.

Response Mode and Scoring: The student selects from the five words the word he thinks the examiner has read by putting an X on the word. The tests are self-scoring in that a special carboned sheet is attached to the student's answer sheet

Technical Information: The author states that "though this test does not have a large standardization group, it has been administered to 153 first graders and their mean score was 11.11." This same sample was given the paragraph meaning subtest of the Stanford Achievement Test. The correlation coefficient between the two tests was 0.79.

Key Math Diagnostic Arithmetic Test by Austin J. Connolly, William Nachtman, and Mil Prichett, 1971, American Guidance Service, Inc.

Description: This diagnostic test of mathematics skills covers: Content (numerations, fractions, geometry, and symbols); Operations (addition, subtraction, multiplication, division, mental computation and numerical reasoning); and Applications (word problems, missing elements, money, measurement, and time). The items in each subtest are arranged in order of difficulty. The test manual lists a behavioral objective for each item. Successful performance on any item implies mastery of the skill sampled at that level. "The identification of these abilities in behavioral normally covered in grades 4 through 8 mathematics curricula. The test may be used for planning individual, small group, or classroom instruction, and for assessing, after a period of instruction what progress the students have made. References to mathematics materials and learning activities corresponding to specific objectives are provided. The test is available in four separate but overlapping levels. The items in the Orange Book deal with the addition, subtraction, multiplication, and division of whole numbers; with the properties of these operations; with number theory, measurement, nonmetric geometry, place value and problem solving. In addition to the above, the Aqua Book covers problem solving and basic operations with fractions and decimals. The Purple Book does not include place value problems. It adds problems on numeration systems, percent, sets, and statistics. Level C has fewer items on basic operations with negative numbers and it adds functions, probability, trigonometry, and reasoning to the topics covered in the Purple Book. Interim Evaluation Tests for use on completion of each unit of study have been developed for all but the C level.

The Progressive Achievement Tests by Warwich B. Elly and Neil A. Reid, 1969, 1970, 1971, Whitcombe and Tombs, Ltd.

Description: This battery represents three language skills tests developed for use in the New Zealand schools. The Reading Comprehension test (1969) assesses factual and inferential comprehension of prose material. The Reading Vocabulary Test (1969) provides an estimate of what proportion of the Wright list of the 10,000 most common words the student knows. The Listening Comprehension Test (1970) assesses both simple recall skills (receptive listening) and inferential skills (reflective listening); it may be used to identify children who need help with listening skills, as an estimate of reading expectancy; or simply as an additional measure of verbal skills. The Reading Comprehension Test and Reading Vocabulary are available in three forms; A, B, and C, with form C reserved for research purposes. The Listening Comprehension Test is available in two forms, A and B. Elley outlines a procedure whereby content-referenced scores can be developed for use with these tests.

Reading Progress Scale by Ronald P. Carver, 1970, 1971, Revrac Publications.

Description: The test is designed to measure reading-input performance, the process by which graphic symbols contained in reading material are decoded or translated into a form which can be subsequently understood and stored. The test results indicate what level of reading material an individual can process. The instrument was constructed on the basis of work done by Bormuth (1969) and Carver (1971). The author states in the manual that "the test is not a traditional norm-referenced test. It has not been designed to maximally discriminate between individuals. It is a type of criterion-referenced test." The author suggests that the Reading Progress Scale be used in research, in evaluation studies, and for placing students in reading groups. Two forms are available.

Prescriptive Reading Inventory by Elizabeth M. Layman, 1972, CTB/McGraw-Hill.

Description: This test is designed to provide information useful in planning individual and class reading instruction. Behavioral objectives are grouped into seven areas: Recognition of Sound and Symbol; Phonic Analysis; Structural Analysis; Translation; Literal Comprehension. The inventory is available in four separate but overlapping levels: the Red Book (Level A), the Green Book (Level B), the Blue Book (Level C), and the Orange Book (Level D). Suggested classroom activities and references to textbook series and reading programs are provided for all the objectives. The publisher states that the PRI is a criterion-referenced test "designed to provide evaluation relevant to classroom instruction, that is PRI evaluates each student's mastery of specific behavioral objectives."

SEL/Project Language Level II, Kindergarten, 1971, Southeastern Education Lab, 3450 International Boulevard, Suite 221, Atlanta, Georgia.

Description: This test was developed for use in conjunction with the SEL/Project Language Level II kindergarten program, a 32-lesson set of materials for rural disadvantaged kindergarten children. The lessons are designed to alleviate language deficiencies through school-readiness activities and through cultural and communication experiences. The items on the test are tied to program activities.

Tests of Achievement in Basic Skills - Mathematics by James C. Young, 1970-1973, Educational Industrial Testing Service.

Description: The tests of Achievement in Basic Skills - Mathematics (TABS) is part of the Individualized Mathematics Program (IMP), a system of mathematics instruction based on performance objectives. The objectives are divided into three categories: Arithmetic Skills, Geometry-Measurement-Application, and Modern Concepts. The MATH-PACKS (lesson units directly related to the performance objectives are eight page individual instruction booklets containing a diagnostic pretest, examples and drill problems, a practice self test, and a separate posttest. The TABS are used for placing students in levels of the IMP. Since each is available in two parallel forms, they may be used independently of the IMP and are currently available for a wider range of grade levels than IMP. The tests are criterion-referenced in that "the items were developed to provide an operational assessment of each of the specified educational objectives in IMP."

There are seven TABS mathematics levels. They are Kindergarten, Grade 1, Grade 2, Level A for Grades 3 and 4, Level B for Grades 4 through 6, Level C for Grades 7 through 9, and Level D for Grades 10 through 12. The Kindergarten test covers: (1) numeration (arithmetic skills); (2) recognition of simple geometric shapes, inside-outside, length, and weight (Geometry-Measurement-Application); (3) problems involving sets, sequences, and the numbers line (Modern Concepts). The Grade 1 test covers: (1) numeration, addition and subtraction of whole numbers , identification of halves, thirds, and fourths (Arithmetic Skills); (2) geometric shapes, length, time, money, liquid measure, purchasing items, and identifying when to add (Geometry-Measurement-Application); (3) set concepts, one-to-one correspondence, inequality, expanded notation, sequences, and odd-even concepts (Modern Concepts). The Grade 2 test covers: (1) numeration, number line operations, addition and subtraction of whole numbers, multiplication with factors not to exceed 5, and the identification of fractional parts (Arithmetic Skills); (2) geometric shapes, length, time, liquid measure, weight, money, and story problems (Geometry-Measurement-Application); and (3) sets, one-to-one correspondence, inequality, expanded notation, and sequences (Modern Concepts). Level A covers: (1) addition, subtraction and multiplication of whole numbers, and identification of fractions (Arithmetic skills); (2) geometric shapes, length, time, money, liquid measure, purchasing items and identifying when to use numerical oeprations (Geometry-Measurement-Application); and (3) set concepts, one-to-one correspondence, inequality, expanded notation, sequences, and odd-even concepts (Modern Concepts). Level B covers: (1) operations with whole and rational numbers (Arithmetic skills); (2) basic geometric concepts, arithmetic measurements, and application of basic mathematics skills to practical problems (Geometry-Measurement-Application); and (3) sequences, number properties, primes, sets, expanded notations, ordered pairs, and divisibility rules (Modern Concepts). Level C covers: (1) operations with integers, rational numbers, irrational numbers, and literal numbers (Arithmetic skills); and (2) basic geometric concepts, arithmetic measurements, and application of basic mathematics skills to practical problems (Geometry-Measurement-Application) and (3) predictions, sequences, functions, number properties, properties of operations, primes, other number bases, and sets (Modern Concepts). Level D covers: (1) Arithmetic skills; and (2) basic geometric concepts, arithmetic measurements, and application of basic mathematic skills to practical problems (Arithmetic Applications).

Territorial Decentration Test by Joseph Stoltman, 1971, (not copyrighted), available from Mr. Joseph P. Stoltman, Department of Geography, Western Michigan University Kalamazoo, Michigan.

Description: The framework for this instrument is Piaget's theory of cognitive development. The test is designed to measure the child's territorial decentration -- one indication of how far the child has progressed in the transition from a preoperational to a logical mode of thought. There are four subjects: Verbal Territorial Identification; Verbal Territorial Relationship; Territorial Inclusion Using Written Symbols; Territorial Inclusion Using Props.

Visual Analysis Test (VAT) by Jerome Rosner, 1971, (not copyrighted), Learning Research and Development Center, University of Pittsburgh.

Description: This test measures the ability to copy geometric designs, a predictor of general visual-motor development. The test items can be used as teaching objectives with the expectation that competency acquired in the behaviors these items represent will be generalized to other related tasks. The author has designed a visual-motor curriculum, which contains over 30 behavioral objectives, and he states that for the purpose of this test 27 of these were treated as test items, producing a criterion referenced test.

Wisconsin Tests of Reading Skill Development: Word Attack: Developmental Edition by Wayne Otto, 1970, National Computer Systems, Inc./Interpretive Scoring Systems.

Description: This series of word attack tests was developed for use with the Wisconsin Design for Reading Skill Development, a prototype for an individually guided reading skill program for elementary schools. The curriculum developers claim that the Wisconsin design "represents a systematic attempt to assess individual pupils' skill development status by means of criterion-referenced tests with respect to explicitly stated behaviors related to each skill." Word attack is only one of six skill areas covered in the design. Of the word attack behavior objectives, some are assessed through formal criterion referenced tests and others are felt to lend themselves better to informal assessment through Guides to Informal Individual Skill Observation (available separately). There are four Word Attack tests. Level A consists of subtests on rhyming words, rhyming phrases, shapes, letters and numbers, words and phrases, initial consonants, distinguishing colors. Level B has subtests covering sight vocabulary, beginning consonant sounds, ending consonant sounds, consonant blends, rhyming elements, short vowels, consonant digraphs, compound words, contractions, base words and endings, plurals, and possessives. Level C includes subtests on the following: sight vocabulary; consonants and their variant sounds; consonant blends, long vowel sounds, vowel + r, a + l, a + w, diphthongs, long and short oo; consonant degraphs; base words; plurals; homonyms; synonyms and antonyms; and multiple meanings. Level D covers sight vocabulary three-letter conconant blends, silent letters, syllabication, accent, schwa and possessives.

Woodcock Reading Mastery Tests by Richard W. Woodcock, 1973, American Guidance Service Inc.

Description: This is a battery of five reading skills tests: Letter Identification; Word Identification; Word Attack; Word Comprehension, and Passage Comprehension; and Passage Comprehension; Scores on the five tests yield diagnostic and instructional information and may be used to predict the student's potential for success at selected reading tasks. Two forms A and B, are available. The manual for the battery provides reference scales whereby teachers can obtain a criterion referenced interpretation of a student's performance.

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